

THE ATTRACT PROGRAMME

A STRATEGIC PROPOSAL FOR BOOSTING BREAKTHROUGH CO-INNOVATION ON DETECTION AND IMAGING TECHNOLOGIES IN EUROPE-PREPARING THE SCENE IN PHASE 1

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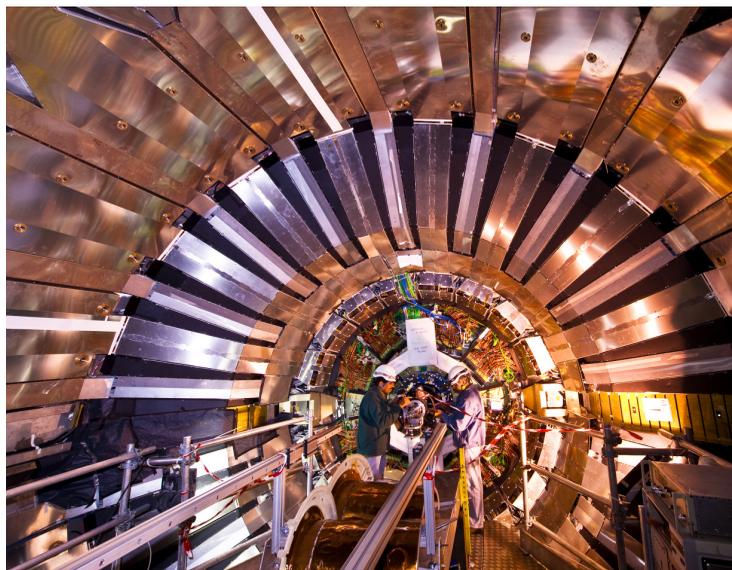
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ATTRACT PHASE-1 PROJECT AIMS

The ATTRACT Phase-1 Project is a pilot for a new collaboration paradigm based on the 'Open Science, Open Innovation and Open to the World'¹ philosophy, which will boost our chances of transforming frontier science into products, processes and services meeting societal needs. It has three closely interlinked aims:

- 1 | To start streamlining the breakthrough innovation process** by coupling national and pan-European Research Infrastructures (RIs) and their associated communities (i.e. universities, Research and Technology Organisations) to actors that can extract societally relevant and/or commercially interesting innovations from them. These actors – including the ATTRACT Phase-1 Project Consortium partners – comprise (1) industry representatives (through EIRMA²) and (2) innovation specialists (through AALTO and ESADE business schools, each with their own SME networks). This streamlined process will be tested and validated through the identification of 170 potential breakthrough technology concepts, which will be steered by the ATTRACT Phase-1 Project Consortium toward societally relevant and commercially worthwhile fields of application.
- 2 | To introduce a co-innovation approach** to invite national and pan-European RIs/university actors, RTOs and industry into a process in which the scientific and industrial communities jointly pursue and generate breakthrough innovation in close and equal partnership.
- 3 | To generate potential breakthrough innovation** in a non-linear fashion by identifying the right (combination(s) of) breakthrough technology options that may achieve the desired solution to a Societal Challenge (effectively recombining technical options to achieve the desired societal result). This enables scientific and industrial research groups to better co-ordinate their research efforts.



¹ Chesbrough, H.W. (2003), "Open Innovation: The new imperative for creating and profiting from technology". Boston: Harvard Business School Press (2003). See also: Christensen, Clayton and Raynor, Michael (2003) in "The Innovator's Solution: Creating and Sustaining Successful Growth". Boston: Harvard Business School Press. See also: W. Chan Kim & Renee Mauborgne (2005) in "Blue Ocean Strategy", Harvard Business School Press.

² European Industrial Research Management Association, with a membership of over 100 major companies across different sectors.

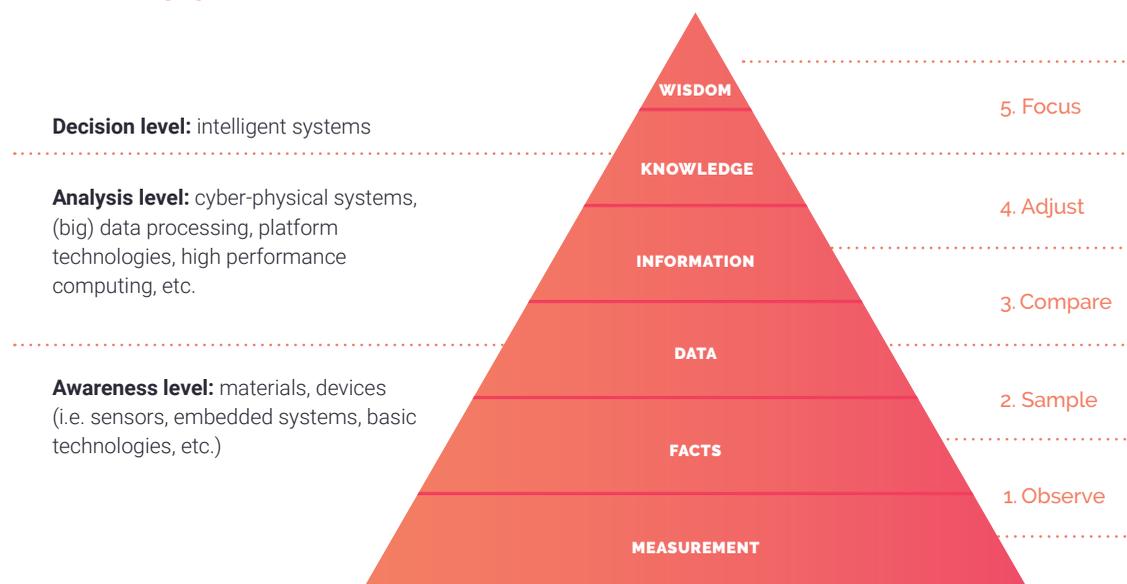
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DETECTION & IMAGING
TECHNOLOGIES AS KEY ENABLERS
FOR BREAKTHROUGH INNOVATION

Various foresight reports by the United Nations³ and the World Economic Forum⁴ as well as recent articles by, for example, the World Technology Evaluation Center⁵ (WTEC) highlight from multiple angles the interdependence of emerging technologies and knowledge convergence needed to explore scientific goals and so-called Societal Mega-Trends. This dynamic relationship gives rise to rapidly evolving applications across industries. It also creates new interdisciplinary spaces for exploring fundamental research, applications, business opportunities and markets. In the Strategic Research Agendas of European Technology Platforms⁶ such as Nanofutures, Photonics21, SusChem, euRobotics, SmartGrids and others, the importance of Detection & Imaging technologies as key enablers for

innovations in their respective sectors can be clearly seen. A recent Frost & Sullivan report also confirms that Detection & Imaging technologies are particularly important enablers for all the converging technological families (see Figures 1 and 2 below). Detection & Imaging technologies also build bridges spanning these families, from sensors to (big) data processing technologies. The report argues that almost all future major scientific advancements, technical applications, commercially worthwhile products or businesses targeting an upcoming Societal Challenge will be enabled by cutting-edge Detection & Imaging technologies. It forecasts that Detection & Imaging technologies will constitute a direct annual market worth over \$100 billion⁷.

Figure 1: Detection & Imaging value chain



³ United Nations, "World Economic and Social Survey 2013 – Global Trends and Challenges to Sustainable Development post-2015", p. 4.

⁴ World Economic Forum, "Deep Shift Technology Tipping Points and Societal Impact – Survey Report 2015", p. 34.

⁵ World Technology Evaluation Center, 2013, "Convergence of Knowledge, Technology, and Society: Beyond Convergence of Nano-Bio-Info-Cognitive Technologies", pp. 225-227. See also: Mihail C. Roco and William S. Bainbridge in: "The New World of Discovery, Invention, and Innovation: Convergence of Knowledge, Technology, and Society", Journal of Nanoparticle Research, Sept. 2013 (taken from abstract: <http://link.springer.com/article/10.1007/s11051-013-1946-1>).

⁶ http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=etp#etps. This site links directly to the websites of the mentioned European Technology Platforms and their respective Strategic Agenda's (under the 'Publications section').

⁷ Frost & Sullivan, "2015 Top Technologies in Sensors & Control (Technical Insights) - Sensors technologies that will have the highest impact in 2015", May 2015, p. 89.

Figure 2: Top 50 Technologies Web

Detection & Imaging technologies impact on almost all major technology areas. (Source: Frost & Sullivan TechVision 2020 Program - Top 50 Technologies).

ADVANCED MANUFACTURING

Advanced Lasers for Manufacturing
Digital Manufacturing
Intelligent Robots
Micro and Nano Manufacturing

MEDICAL DEVICES & IMAGING

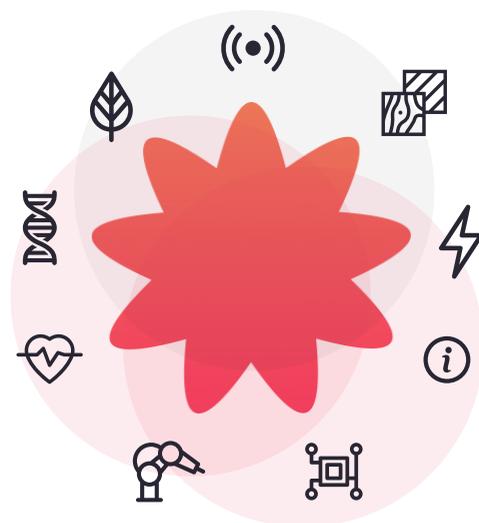
Combination Devices
Digital Pathology
Hybrid Imaging Technologies
Medical Robotics
Optical Imaging Technologies
Smart Pills

LIFESCIENCES & BIOTECHNOLOGY

Adult Stem Cells
Biosensing
Genome Sequencing
Nanofluidics & BioNEMS
3D Cell Culture Systems

CLEAN & GREEN TECHNOLOGY

Advanced Energy Storage
Green Buildings
Green Vehicles
Renewable Chemicals
Smart Grid
Thin Film Photovoltaic
2nd Generation Biofuels



SENSORS & AUTOMATION

CBRN Detection Technologies
Energy Harvesting
Smart Sensors
Wireless Sensor Networks

MATERIALS & COATINGS

Algae-based Ingredients
Advanced Filtration
Breathable Antibacteria Coatings
Compostable Packaging
Enzyme Technology
Lightweight Composites
Nanocatalysts
Smart Textiles
Superhydrophobic Coatings

CONVENTIONAL ENERGY

Advanced Hydrocracking
Clean Coal
Enhanced Oil Recovery

INFORMATION & COMMUNICATION TECHNOLOGY

Cloud Computing
Fabric Computing
Long-Term Evolution
Semantic Web
Virtualisation

MICROELECTRONICS

Emerging Data Storage Technologies
Flexible Electronics
Haptics & Touch Technologies
Next Generation Displays
Wireless Power Transmission
3D Integration
LED Lighting Technologies

Here are some examples, based on Figure 2:

- > **Mega-trend: Connectivity & Data Traffic.** By 2020 there will be over 80 billion⁸ connected devices. Users will own and operate at least five connected devices and households will have at least 10. With the advent of the 'Internet of Things', the number of devices with online identities (digital IDs) per km² will skyrocket. The challenge will be: (1) to deal with the exponential increase in data traffic and (2), to take advantage of the data deluge. ERIs already have technologies that can analyse 3200 terabytes of data a year⁹. The question is how to transfer the scientific knowledge to do this to application areas such as energy management, global emergency response, weather forecasting etc.
- > **Mega-trend: Air Mobility.** Between 2009 and 2028, world passenger traffic is forecast to increase 5% per annum¹⁰ and world cargo traffic by 5%. Traffic will nearly triple, and airlines will more than double their fleets. According to Boeing, the commercial fleet will grow from 21,600 aircraft in 2014 to 44,000 aircraft in 2034. The biggest challenge for Europe will be to maintain its technology leadership. One way to do this could be to use opto-electronics sensing technology developed by ERIs for fundamental research to perform real-time monitoring of the technical health status of the airplane. This would cut costs for airlines and enable more efficient maintenance scheduling.
- > **Mega-trend: Zero Emissions.** In 2002, the carbon footprint of data centres worldwide was 76 million metric tonnes of CO₂e¹¹. This is expected to more than triple by 2020, making it the fastest-growing contributor to the ICT sector's carbon footprint. The big challenge is to achieve a zero-emission ICT industry and in doing so help reduce the CO₂e footprint of other industrial sectors. One option is to investigate how the hardware (i.e. micro-cooled ASICs) and software (e.g. cloud computing) technologies currently being developed by different national and pan-European RIs for large instruments can be put to work to reduce the global CO₂e footprint of commercial data centres.
- > **Mega-trend: Personalised Medicine.** The risk of getting cancer is rising as Europe's population ages. Between 2002 and 2012 the number of new cancer cases rose by 20% to 3.4 million a year¹², with an associated cost burden. Chips such as the one developed by the MediPix consortium¹³ are already being applied in X-ray CT, in prototype systems for digital mammography, in CT imagers for mammography and for beta and gamma autoradiography of biological samples. However, if we are to create more personalised treatment options, we need much faster scanners, to check more people more quickly, with better resolution and tumour targeting to improve the identification of tumours.

⁸ The American convention (The short-scale échelle courte) is used throughout for 'billion' (10⁹)

⁹ http://atlasexperiment.org/pdf/fact_sheet_1page.pdf.

¹⁰ Airbus 2009-2028 Global Market Forecast: <http://www.aircargonews.net/news/single-view/news/boeing-ups-aircraft-demand-expectation.html>.

¹¹ Equivalent CO₂ (CO₂e) is the concentration of CO₂ that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas.

¹² Ferlay J, Steliarova-Foucher E, Lortet-Tieulent J, Rosso S, Coebergh JWW, Comber H, Forman D, Bray F in "Cancer incidence and mortality patterns in Europe: estimates for 40 countries in 2012". Eur J Cancer. 2013 Apr;49(6):1374-403. doi: 10.1016/j.ejca.2012.12.027. The mortality rate from cancer is 51% within 5 years. See for details: <http://eco.iarc.fr/EUCAN/Cancer.aspx?Cancer=0>.

¹³ <http://medipix.web.cern.ch/medipix/index.php>.

Figure 3 is an overview of further mega-trends in which Detection & Imaging technologies play a key role:

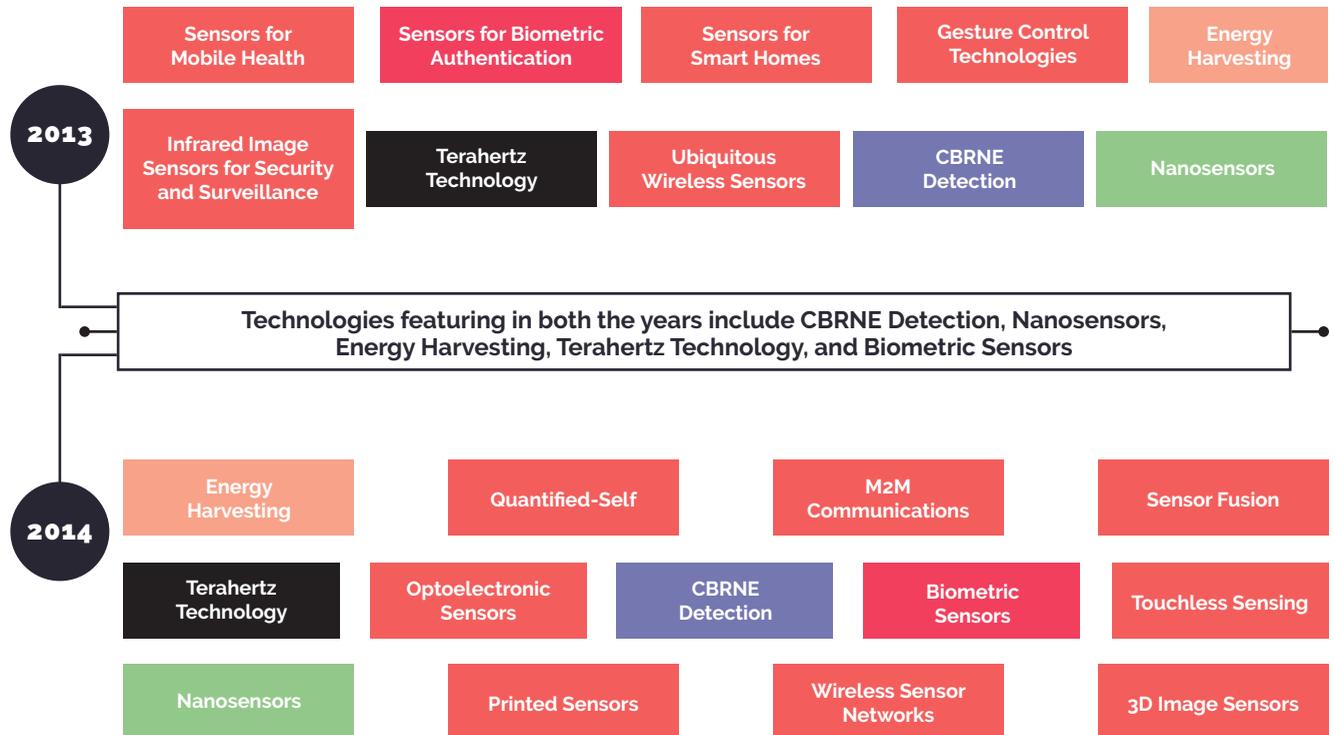


Figure 3: Main technology trends in Detection & Imaging (Also see Chapter 2 on Impact for a more detailed description). (Source: Frost & Sullivan, Megatrends in Technology Convergence).

The ATTRACT Programme has been developed against the backdrop of the aforementioned reports. It starts with a seed-funding mechanism (ATTRACT Phase-1 Project) to identify a wide range of Detection & Imaging technologies (Technology Readiness Levels 2-4) with breakthrough potential. It is planned to follow with a scale-funding approach (ATTRACT Phase-2 Project) in terms of industrial scalability (toward TRL 5-8) to create social added value¹⁴. The ATTRACT Programme (building upon the Phase 1 and Phase 2 Projects), will create an

ecosystem within which Europe’s leading national and pan-European RIs and their associated user communities, RTOs, large and small industry, and the private investor communities can co-operate to turn curiosity-driven, frontier research efforts into new products, processes and services. The phased deployment of the ATTRACT Programme will spark a new wave of young entrepreneurs, small ventures and innovative services that can support growth and jobs for years to come.

Business and innovation experts



Private and public funding



European Commission

Research Infrastructures



Industry



Figure 4: Illustration of the ATTRACT Programme Co-Innovation model showing the inter-relationship and interdependence of scientific research groups in RIs, RTOs business innovation experts, industry.

¹⁴ The ATTRACT Consortium has established a dialogue with the EC for a potential phase 2 within Horizon 2020.

The ATTRACT Programme will create a sustainable innovation ecosystem by repeating the seed-funding and scale-up stages of the ATTRACT Phase-1 and Phase-2 Projects¹⁵, and adding further mechanisms to help breakthrough research turn into breakthrough innovations. This proposal represents the first phase of that cycle, in which an independent committee¹⁶ of top-level experts in Detection & Imaging technologies identifies high-risk scientific ideas, concepts and technologies that may have breakthrough innovation potential. Funding from H2020 is needed to kick-start this process of co-innovation (see below for explanation of the concept). The ATTRACT Phase-1 Project is shown as the grey part in Figure 5 below.

Once the ATTRACT Phase-1 Project has proven itself by identifying, selecting and guiding 170 high-potential technology concepts, the **second phase in the innovation cycle** (e.g. ATTRACT Phase-2 Project; not funded by this Call) will launch a scale-funding mechanism so that Europe's academic research communities, large and small companies and private investor groups can hone these technologies and take their outcomes to market.

The envisioned ATTRACT Phase-2 Project is shown in yellow in Figure 5 below.

The ATTRACT Phase-2 Project is mentioned here because it is considered key to furthering selection of the most promising breakthrough concepts funded by the ATTRACT Phase-1 Project on the path to market (moving project concepts from TRL 2-4 up to TRL 5-8 and therefore for the success of the ATTRACT Programme model. By using a dedicated selection procedure targeting scientific excellence and innovation potential with careful project monitoring, the ATTRACT Phase-1 Project will create a pipeline of projects that are well qualified for further development and funding in the second phase. The ATTRACT Phase-1 Project Consortium has already done much of the groundwork for this through (among other actions) several investor community meetings in London, successful technology scoping exercises in Barcelona and Strasbourg (see section 1.5 and Annex 1 for details) and a symposium at AALTO University in Finland on how to engage with the innovation expert communities.



¹⁵ The ATTRACT Programme is envisioned by the Consortium in the next Framework Programme FPg; initial discussions are taking place with the EC.

¹⁶ Later in this proposal, this independent committee is referred to as the "RDI Committee" or the "IC". Its specific role is outlined later in the document.

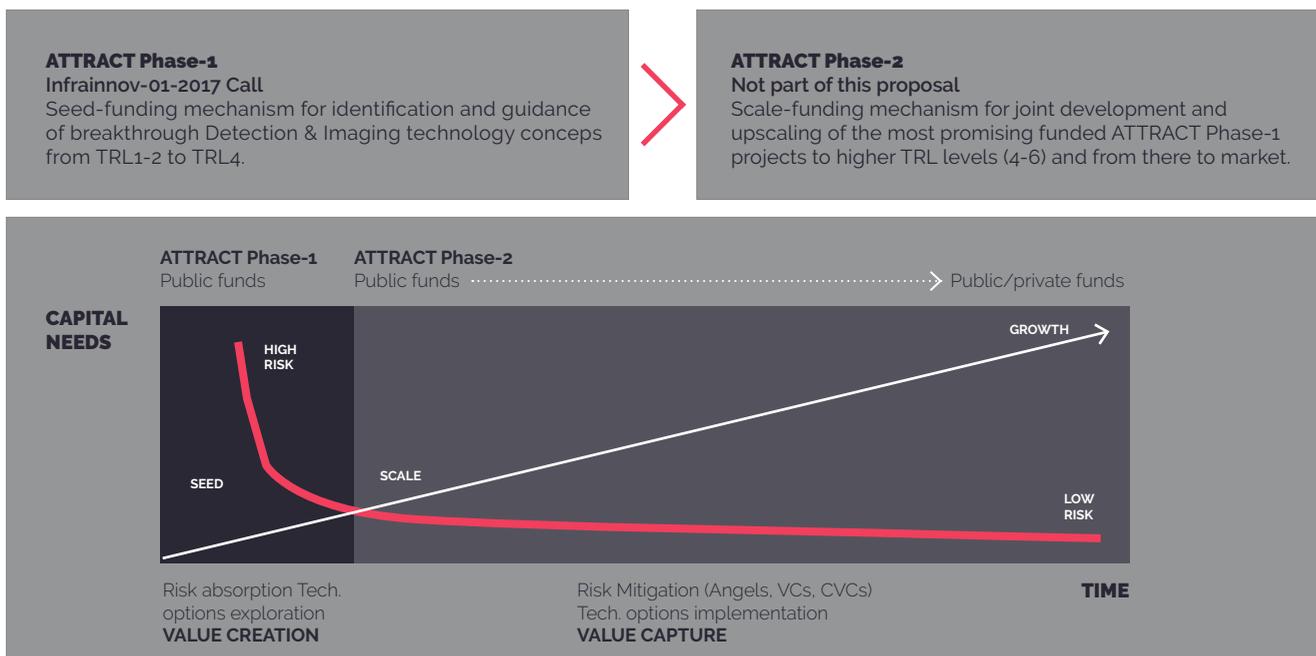


Figure 5: This Figure illustrates ATTRACT Phase-1 and Phase-2 Projects. The ATTRACT Phase-1 Project is a seed-funding mechanism for the identification of high-risk, high-gain technologies to bring them up towards TRL 4 and above. In a continuous and structured manner, the envisioned ATTRACT Phase-2 Project will create societal and economic value from the scientific ideas and technologies of the ATTRACT Phase-1 Project using public funding to the point where it becomes a financially sustainable/acceptable risk for private investment communities.

The proposed ATTRACT Phase-1 Project goes far beyond creating a spin-out machine for specific technologies. It is a seed-funding mechanism for innovation fit for 21st century needs. By sustaining the research and development of highly promising technologies from ATTRACT Phase-1 into ATTRACT Phase-2, the ATTRACT Programme will bring together entrepreneurs, scientists, engineers, investors and cross-disciplinary innovation and entrepreneurship students to jointly develop specialised technologies to find new ways of solving economic and social problems. Can we use sensors to help the visually impaired navigate the world more easily? Can we develop better forms of on-line learning? Can we pioneer ways to monitor our changing climate more accurately and cost effectively – and develop strategies to mitigate the damage? Answering these questions requires an open, sharing attitude from the outset, so breakthrough innovation concepts can be rapidly identified, assessed, industrially scaled or rejected by various experts along the innovation value chain exploring them at once. As the ideas move towards a real product or service, it is vital that their value is captured for scientists, innovators, their investors, the economy and society.

3

ATTRACT PHASE-1
PROJECT OBJECTIVES

THE OVERALL ATTRACT PHASE -1 PROJECT OBJECTIVES ARE AS FOLLOWS:

- 1 | It will become an **open and inclusive platform**, creating the next generation of Detection & Imaging technologies rooted in ground-breaking, fundamental science use with anticipated applications in the fields of medicine, manufacturing industry, aerospace, ICT, engineering and beyond. It will bring together the existing innovation potential, know-how and expertise of national and pan-European RIs and their associated user communities, industry (large corporations and specialised SMEs) and Innovation and Business organisations.
- 2 | It will embrace one of the key lessons of innovation: radical technology development is based on the premise of 'high-risk/high-pay-off', and a tolerance of, and rapid learning from, failure if some developments turn out to have a less-than-expected market potential (directly or embedded) or fail on scientific grounds. The critical point is that the decision to continue, adapt or end a development can be taken quickly, so that scientific capacity and/or financial investment can be diverted if necessary. The Project will take the first important step toward parallelisation and rapid assessment of potential win-win (industry-science) opportunities to enable better and faster forecasting of the prospects of success for all sides, leading to faster time-to-science & market (see Figure 6).
- 3 | The ATTRACT Phase-1 Project 'Final Assessment Conference' will present the breakthrough technology potential of the 170 funded technology concepts and by fostering relationships with private investors (already on-going), trigger the interest of private capital.
- 4 | The ATTRACT Phase-1 Project thus becomes the vehicle for scientific and industrial research groups and private investors in the multiple application fields to decide which concepts to move further up the TRL ladder. This will be of critical importance for fostering and strengthening fast innovating (micro)-SMEs as well as for channelling projects with the potential for rapid scaling to large firms.

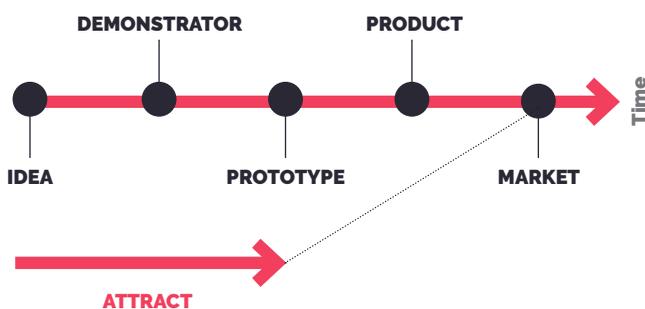
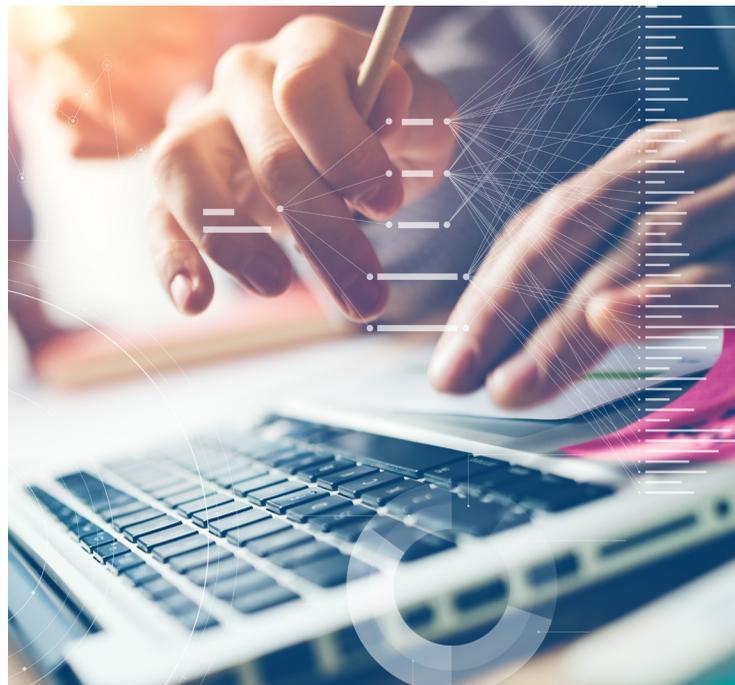


Figure 6: The ATTRACT Phase-1 Project will be the first major step in an iterative cycle in a much faster technology development pathway that will result in a faster time-to-science & market for new breakthrough innovations.

THE ATTRACT PHASE-1 PROJECT SPECIFIC OBJECTIVES ARE TO:

- 1 |** Identify a minimum of 170 breakthrough concepts or technologies (TRL 2-4) in the domain of Detection & Imaging technologies across Europe with the aim of boosting job creation in the EU Member States and Associated Countries.
- 2 |** Assess, through peer review by an Independent RDI [Research, Development, Innovation] Committee (hereafter referred to as the 'IC') from within the domain, the technical feasibility and innovation potential of the identified opportunities.
- 3 |** Fund 170 expert-evaluated breakthrough opportunities/concepts (each receiving €100,000 of seed funding) toward the development of a proof-of-concept or prototype while keeping in mind applications beyond fundamental research.
- 4 |** Guide the funded opportunities by providing technical and business concept advice toward conversion to breakthrough innovations by using the expertise of top-level independent technical experts from the IC and Europe's leading business schools and who are members of the ATTRACT Phase-1 Project Consortium.
- 5 |** Initiate and promote a mechanism to capture the interest of private investors (Business Angels, Venture Capital firms, corporates) to facilitate the leverage of private capital out of public funding.
- 6 |** Select and – if relevant and possible - cluster opportunities with a clear potential for successful industrial implementation (transition towards private investment market).
- 7 |** Strongly contribute to the achievement of a more evenly spread European Innovation Area in which researchers, scientific knowledge and technology circulate more freely.



The 'Open Science to Open Innovation' approach of the ATTRACT Programme and its link with young entrepreneurs was discussed in a symposium held at AALTO University¹⁷ in Espoo (September 2016). There, it was confirmed that at present, the training of students at many RIs does not include interdisciplinary and entrepreneurship elements; students tend to carry out a pre-specified set of tasks with little scope for communication with fellow students working on other projects. The symposium investigated novel ways to bridge/link basic and frontier research to more applied Design Thinking philosophies¹⁸ and similar methodologies taught in MSc programmes¹⁹ and in companies such as IBM, SAP and IDEO²⁰, where technologies are 'just' a functional way to solving an identified real-world need. The thought behind this is that this link will also significantly contribute toward a more evenly spread European Innovation Area.

The result of this symposium was to add another objective for the ATTRACT Phase-1 Project, which is to run a pilot programme with young MSc interdisciplinary student teams based on Design Thinking methodologies. The pilot programme will be inspired by the breakthrough technologies and innovations funded in the ATTRACT Phase-1 Project. The purpose of this pilot is to:

- 1 |** Use Design Thinking methodologies to extract social value directly from the fundamental science realm.
- 2 |** Demonstrate how an entrepreneurship and co-creation mind-set could be instilled in novel ways to pursue social benefit.
- 3 |** Complement the current training methods of MSc students in RIs in novel ways.
- 4 |** Analyse the lessons learned in this pilot for the scale-up in the ATTRACT Phase-2 Project and the ATTRACT Programme.



THE OUTCOMES OF THE ATTRACT PHASE-1 PROJECT WILL BE:

- > **A bigger economic and societal return on Europe's scientific investment into national and pan-European RIs;**
- > Proof of the effectiveness of the new paradigm as a mechanism for developing radical technologies created in the service of science into breakthrough innovations with industrial relevance and high societal value;
- > A mechanism to prequalify early-stage technology developments for scale funding, by delivering a fast and rigorous assessment tool for making smart selections of breakthrough technology concepts and converting them into breakthrough innovation, so that private investment communities can then decide on industrial scalability, potential market value and therefore investment;
- > A significant contribution toward the establishment of a new generation of interdisciplinary scientists, engineers and innovative entrepreneurs, who are inspired by Design Thinking²¹ to create socially valuable innovation out of instrumentation that was developed for implementation of RIs' scientific missions;
- > A significant contribution to a scientific culture of Open Science and Open Innovation across Europe.



²¹ See e.g. T. Brown, Change By Design, Harper-Collins (2009); M.G. Luchs, K.S. Swan, A. Griffin (eds.) in "Design Thinking", Wiley (2016).

Table 1 below shows the expected benefits from participation in ATTRACT Phase-1 Project for each kind of stakeholder.

BENEFITS	
Research Communities	<ul style="list-style-type: none"> - Access to complementary industrial talent, know-how and industrial manufacturing capability. - New opportunities to further develop and speed-up technology upgrading programmes. - Seed long term collaborative links with industry. - Opportunity to learn and apply Design-Thinking methodologies.
Industry	<ul style="list-style-type: none"> - Access to a unique network of know-how and talent in national and pan-European RIs and their scientific user communities. - Contributing as co-developers (not just as 'old school' sub-contractors). - Access to new industry networks via other projects funded through ATTRACT Phase-1 Project. - Lower costs and shorter time to market for developing breakthrough applications. - Development of new applications for new markets.
Private Investment Communities	<ul style="list-style-type: none"> - A structured mechanism for learning about potential breakthrough technologies in RIs. - Early identification of potential innovation investment options for technologies coming out of RIs. - Structured platform for interaction with RIs and industry toward joint development of breakthrough technology.
Young entrepreneurs	<ul style="list-style-type: none"> - Opportunity to learn about potential breakthrough technologies in RIs and apply modern skills (e.g. Design Thinking) to create novel, societally relevant ideas for future market applications. - Access to a unique network of scientific user communities. - A platform for interaction with Private Investment Communities and industry collaborations.

Table 1: The main benefits that ATTRACT Phase-1 Project will bring to industry, the Detection & Imaging research communities, and potential private investors and young entrepreneurs.



4



RELATION TO PRINCIPLES
OF OPEN SCIENCE
AND OPEN INNOVATION

This ATTRACT Phase-1 Project is submitted as a result of a three-year process of engaging in iterative discussions between some of Europe's leading RIs, some large industry players and several private investment communities with close ties to niche SMEs²². A special ATTRACT website (<https://attract-eu.com/>) was created to provide the various stakeholders with information about the Programme and its two Phases, and to help them take part in round-tables. These discussions revealed that both industry and investors regard RIs as providers of leading-edge technologies with high innovation potential but that the design and development of components, instruments, services and knowledge is not always sufficiently exploited to improve existing applied technologies. In many cases, the knowledge and innovation potential that could have been harnessed by industry have not been used or valued sufficiently by RIs to speed up development. Furthermore, too little attention has been paid to applying jointly-developed technology in novel, highly advanced market applications.

This issue has also been investigated by Prof. Henry Chesbrough of the University of Berkeley and ESADE in his influential work on moving from Open Science to Open Innovation²³. Chesbrough, through his advisory role in the ATTRACT Phase-1 Project Advisory Committee (PAC), has greatly helped the Consortium to strengthen this link. To confirm that there really is an unmet need, the ATTRACT Programme Consortium (which is the same as the ATTRACT Phase-1 Project Consortium Board) undertook two preliminary scoutings of breakthrough research projects. The first two-day 'Technology Trends, Wishes and Dreams' (TWD) Symposium on Detection & Imaging Technologies, held at ESADE in Barcelona in June 2016, was a big success: 80 breakthrough technology project concepts were presented²⁴ from across the Detection & Imaging community. Over 180 scientists, industry researchers and interested private investment parties attended this event (see Figure 7 for an impression of the meeting). Due to over-subscription, a second scouting symposium was held in Strasbourg in November 2016 and led to the presentation of 22 additional concepts and attendance by a further 72 participants²⁵.

²² The ATTRACT Programme Consortium participated in several Global Corporate Venturing conferences to test the model against the needs of corporate and private investors. See: <http://www.eventbrite.co.uk/o/global-corporate-venturing-mawsonia-ltd-5408982681>.

²³ For his most recent publication, see: <http://www.sciencebusiness.net/eventsarchive/OpenScience/OpenScience.pdf>. This paper provides the theoretical basis for the ATTRACT model.

²⁴ See for details: <https://indico.cern.ch/event/470460/>. Details of a selection of the presented project concepts are shown also in Annex 1 of this proposal.

²⁵ See for details: <http://indico.cern.ch/event/542659/>.



Figure 7: Pictures taken during the two first 'Technology Trends, Wishes and Dreams' (TWD) Symposia on Detection & Imaging Technologies in Barcelona (June 2016) and Strasbourg (November 2016).

The ATTRACT Phase-1 Project is an essential part of the envisioned ATTRACT Programme's co-innovation paradigm for implementing the transition from Open Science towards Open Innovation²⁶. Both the ATTRACT Phase-1 Project and the ATTRACT Programme as a whole can thus be placed in the top-right Pasteur Quadrant

(see Figure 8 below). The Pasteur Quadrant²⁷ is a classification of scientific research projects or initiatives that seek fundamental understanding of scientific problems, while also being of immediate use for society. It distinguishes various perspectives within science, engineering and technology.

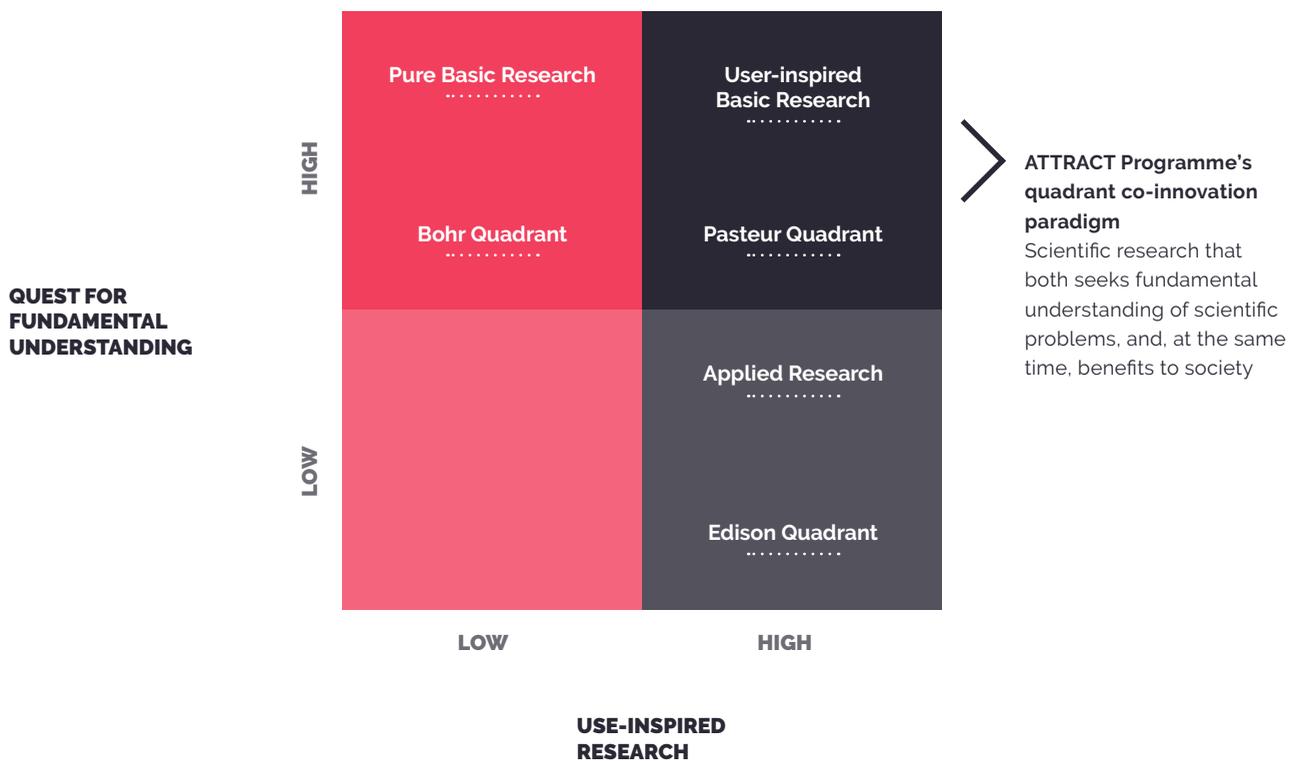


Figure 8: The co-innovation paradigm as proposed by the ATTRACT Phase-1 Project and the wider envisioned ATTRACT Programme fits in the top right Pasteur Quadrant.

²⁶ H.W. Chesbrough, "From Open Science to Open Innovation", ESADE Working paper, Science|Business Publishing 2015.

²⁷ Stokes, Donald E. in "Pasteur's Quadrant – Basic Science and Technological Innovation", Brookings Institution Press (1997) p. 196.



CONCEPT AND APPROACH



CONCEPT

The ATTRACT Phase-1 Project Consortium strongly believes that societal problems cannot be solved using incrementally improved technologies developed in competition by different research groups²⁸. This is because such an approach leaves group collaboration in pursuit of a breakthrough solution largely to chance. Furthermore, this approach is very time-consuming, expensive and does not foster co-ordination of and synergy in publicly-funded research programmes. This model also makes it difficult for companies and investors to take informed decisions on which technologies to back, thus leaving worthwhile projects unfunded.

As outlined in Section 1.1, the ATTRACT Programme's vision is that:

- 1 |** The pursuit of fundamental science is uniquely placed to lead to breakthrough technologies.
- 2 |** When these breakthrough technologies arise through co-innovation (i.e. pursuing win-win opportunities) between research communities and industry, they can generate societal value more quickly and efficiently, saving costs, research capacity and resources.

This vision will be implemented through Open Innovation, which emphasises partnering for mutual advantage and access to skills and resources one would otherwise have to develop by oneself. Open Innovation also allows for failures in technology development, as radical ideas can be tried and tested faster. An ecosystem based on Open Innovation will help industry to identify which breakthrough technologies needed for frontier research have market potential. The ATTRACT Programme's success should be measured in terms of:

- > Increased returns on investments into European RIs.
- > Enhanced use of RI capacity and technology by industry.
- > More private investment in high-gain technology as the ATTRACT Programme effectively 'de-risks' part of the technology development.
- > Greater research mobility between and across scientific and industrial research groups.
- > Better harnessing of cross-disciplinary student innovation potential in universities and business schools, resulting in an overall strengthening of the European Research Area.

²⁸ See: S Singh in "New Mega Trends Implications for our Future Lives", Palgrave Macmillan UK, 2012. See also: B. Schneiderman in "Science 2.0". Science, March 2008, vol.319, pp. 1349-1350.

REASONS FOR THE THIRD-PARTY REDISTRIBUTION MECHANISM

The ATTRACT Phase-1 Consortium members find the Third-Party redistribution mechanism offered by the EC an excellent instrument for:

- > Ensuring future availability of Detection and Imaging technologies for the purpose of supporting RIs' future technology upgrading programmes, leading to key advances in fundamental science.
- > Establishing better connection and synergies between national and pan-European RIs and their associated research communities.
- > Increasing the visibility of the pan-European RIs to scientific research communities that have so far not been engaged or even been aware of the potential that pan-European RIs have to offer in terms of basic scientific instrumentation.
- > Continuing to attract young research talent across and beyond Europe.
- > Supporting the sustainability of SMEs so they can continue to develop, manufacture and deliver the necessary instrumentation needed for basic research.

APPROACH

The ATTRACT Phase-1 Project will act as a seed funder for 170²⁹ carefully selected technology concepts, cascading €17 million (out of the €20 million requested H2020 funding) through an Open Call to RI-academia-RTO-industry consortia. It will distribute the funding to successful proposals as a lump sum of €100,000 at the start of each of the projects. The reason for allocating €100,000 per funded project is that:

- 1 | This amount allows a larger geographical reach of public funding across the EU Member States and Associated Countries.
- 2 | It spreads available EU funding more evenly between large companies and SMEs.
- 3 | It facilitates the entry of new participants or non-experienced organisations in European funding programmes (i.e. small universities and polytechnics, recently created SMEs etc.).
- 4 | The time for implementing the selected ATTRACT Phase-1 Open Call projects is 12 months; the amount is balanced against the time the projects have to develop a conceptual prototype.

²⁹ Since the European Commission Call text clearly specifies that the financial support to Third-Parties is the primary aim of the Action, the number of 170 fundable projects has been established as a result of maximising Third-Party funding and allocating sufficient resources for the management of the ATTRACT Phase-1 Project.

FINANCIAL ASPECTS BEARING ON IMPLEMENTATION OF THE ATTRACT PHASE-1 PROJECT SEED-FUNDING MECHANISM

- 1 |** The seed-funding mechanism will entail the lump sum payment of €100,000 to each selected project consortia (e.g. Third-Parties), with a maximum of 170 funded projects.
- 2 |** Funding is provided after successful conclusion of a Third-Party Agreement (TPPA).
- 3 |** Each funded project will last one year after the TPPA has been signed.
- 4 |** The ATTRACT Phase-1 Project Consortium will report on technical and financial progress to the EC, in line with standard requirements of the H2020 R&I Work Programme (see above).

THE PROCESS FOR THE ATTRACT PHASE-1 OPEN CALL

The bodies in charge are: the Project Consortium Board (PCB; highest decision-making authority); the Independent RDI Committee (IC); the Project Advisory Committee (PAC; committee linking the ATTRACT Programme to corporate and private investment interest); the Project Administrative Office (PAO; day-to-day project implementation office). Their composition, roles and responsibilities are described in Section 1.6.

1 | Identification of ATTRACT Phase-1 Open Call themes

The ATTRACT Phase-1 Project Open Call will be challenge-driven, bottom-up and cover Detection & Imaging technologies, categorised as: sensors,

front and back end electronics, data acquisition systems and computing, software and integration. The Open Call will focus solely on identifying breakthrough challenges. These themes are a standard classification recognised by the RI and Industrial communities in Europe. This process is led by the IC. The IC will include top-level researchers from the domain of Detection & Imaging, specialists from potential user-communities as well as potential industry users of the technology. The IC is independent from the ATTRACT Phase-1 Project Consortium (i.e. Consortium partners are not part of the IC, to guarantee that the funding decisions are decoupled from the Consortium). The administrative and logistic process of implementing the Open Call process is handled by the PAO.

2 | Publication and management of the ATTRACT Phase-1 Open Call application process

Organising and managing the Open Call is the responsibility of the PAO, which has a logistic and administrative role. To raise awareness of the Open Call among the various research communities (national RIs, academic centres, Research & Technology Organisations (RTOs), corporate industry and specialised SMEs), the PAO will work closely with the Phase-1 Project Consortium's Technology Transfer Offices (TTOs) and also use several other channels, such as the ATTRACT website. This approach has been tested with great success in the aforementioned 'Technology Trends, Wishes and Dreams' (TWD) Symposia on Detection & Imaging Technologies in Barcelona and Strasbourg. EC communication channels (see WP6 for details) including the EC Participant Portal and the EU*Research Focus/Results Magazines will be used to create the widest possible awareness among researchers of the funding scheme.

Together with the Open Call publication, the PAO will publish all necessary supporting documentation for potential applicants and an FAQ based on questions that arise from interested parties. This includes the evaluation criteria that will be used by the IC (see below for details). The PAO will also provide and manage the electronic submission process set up for the ATTRACT Phase-1 Project and offer an online helpdesk. Proposals will be limited to 4 pages (excluding the title page and public summary), with clear guidelines on the structure of the proposal given in the supporting documentation. The proposal application sections are as follows:

The Call will remain open to applicants for three months. Once the Call is closed, the proposals will be forwarded to the IC for evaluation and selection. Upon request from the IC Chair, the PAO will provide administrative support services to the IC members carrying out the evaluation and selection.

- 1|** Project public summary (max. 3000 characters).
- 2|** Project description (describing the objectives).
- 3|** Technology benchmark (describing how the technology developed in the project compares to existing technologies).
- 4|** Envisioned innovation potential (describing how the innovation potential (scientific and/or industrial) is seen on a time horizon within the next decade. It should also describe how such envisioned potential could benefit European society and their citizens).
- 5|** Project implementation, budget breakdown and final deliverables (describing how the project will be implemented (steps) within the course of its twelve-month duration. An indicative budget breakdown (personal costs, travel, equipment, other...) will be provided for €100 k funding. A table will be included of expected results after twelve months of work.

Special attention shall be paid to the deliverables to ensure proper public dissemination of the project results). Open sharing of project information and deliverables is encouraged among all applicants. At the very least, applicants must undertake to provide public dissemination for the following deliverables at the ATTRACT Final Assessment Conference in Brussels:

- A|** A final project summary in PDF format running to no more than 2000 characters, including spaces.
- B|** A poster presentation (format to be announced no later than two months before the ATTRACT Final Assessment Conference).
- C|** A 'scientific journal-type' article summarising the main project results and methodology used to achieve them.

3 | Selection of proposals to be funded

The IC is an independent body; it will not include any ATTRACT Phase-1 Project Consortium partners, to demonstrate a complete decoupling between the management of the seed-funding programme and the evaluation and selection of individual projects. It comprises top scientific and industrial experts in Detection & Imaging technologies and leading representatives of private investment communities. After careful assessment (maximum three months after the Open Call is closed) the IC will evaluate the submitted proposals, draw up a ranking list and specify which ones should be funded. The assessment criteria for the IC are as follows (in line with the proposal template structure above), with a weighted score per section:

The IC's ranking list and funding recommendation is forwarded to the PCB, which will verify and confirm in their meeting that the evaluation process has been carried out transparently and in accordance with EC Appendix K of the Work Programme. The names of the IC members will be published on the ATTRACT website when the Open Call process is launched as a proof of the IC's top scientific, industrial and investment innovation quality, adding to the transparency of the process. As shown above, the ATTRACT Phase-1 Project intends to launch a single Open Call. In the unlikely event that the response is lower than 500 and/or does not generate 170 IC-selected high potential concepts, an additional Open Call may be launched one month later.

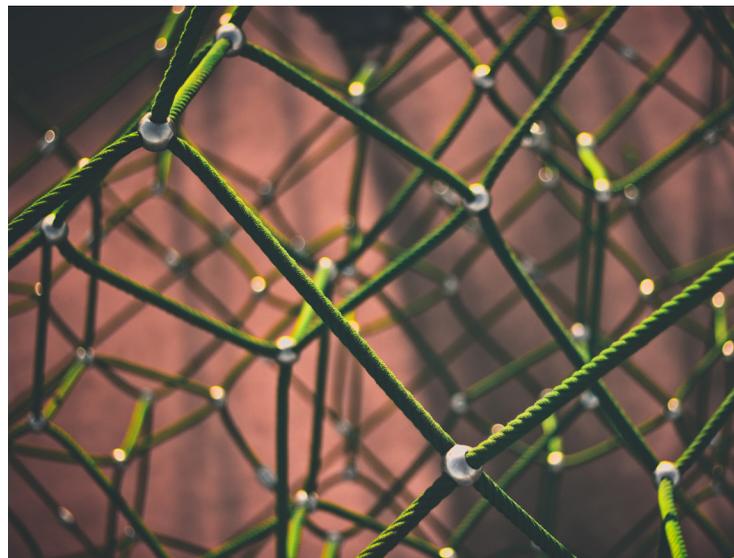
- 1 | Are the project proposal objectives adequately and clearly defined?
- 2 | Are the project proposal objectives adequately and clearly explained?
- 3 | Is the technology proposed for development clearly an advance on the state of the art?
- 4 | Will the scientific use increase knowledge in the scientific discipline(s) mentioned?
- 5 | Will the expected advances have the potential to contribute to improved or new industrial applications?
- 6 | Will the potential scientific and/or industrial applications benefit European society and citizens?
- 7 | Are the project implementation steps fully explained?
- 8 | Do the proposed implementation steps show that the anticipated results are achievable within twelve months?
- 9 | Does the budget breakdown correspond to the presented implementation steps and is it reasonable?
- 10 | Does the proposal support openness?

4 | Post-selection process

After confirmation by the PCB, the PAO will publish the evaluation results of the selected applicants, send personal notifications to the Third-Parties and commence the funding contract process with successful applicants, based on the ATTRACT TPPA and a single lump sum payment of €100,000 per funded project. The contracting process is expected to be completed within one month. It should be noted that the TPPA is a standard contract whose provisions are not open to individual negotiations between the ATTRACT Phase-1 Project PCB and the selected Open Call applicants. This ensures equal treatment of all ATTRACT Phase-1 Open Call applicants and a timely conclusion of the TPPAs.

Funded projects will have one year to produce their results (also called 'deliverables'). The PAO will ensure the administrative follow-up and that scientific and technical progress is monitored for each project. The PAO will not interfere in the way the allocated funding is spent to achieve the project's aim. In close collaboration with the IC, WP5 will be responsible for the scientific and technical monitoring of funded projects and provide (some) advice, guidance or network access if requested and agreed by the PCB. WP5 will not interfere, delay or stop ongoing projects but will refer any significant deviations encountered via the PAO to the PCB for further action. During the year, business and innovation experts from the ATTRACT Phase-1 Project Consortium's leading university (AALTO) and business school (ESADE), will provide assistance (in the form of guidance or coaching, depending on requirement) to the projects to help them understand

how the breakthrough technology might be transformed into breakthrough innovations with high market relevance and potential. This does not mean that ATTRACT aims to turn research scientists and technology developers for leading-edge science into entrepreneurs for it is generally so that they would have taken other career paths if they had wanted to be entrepreneurs/businessmen. The training support will focus on showing these scientists: (1) how business works, (2) providing them with introductory business knowledge so they can better assess the market potential of their technology (3) making the researchers effective partners in business processes and (4) smoothing the path for those researchers interested in becoming entrepreneurs.



The ATTRACT Phase-1 Project operational concept is summarised in Figure 9 below:

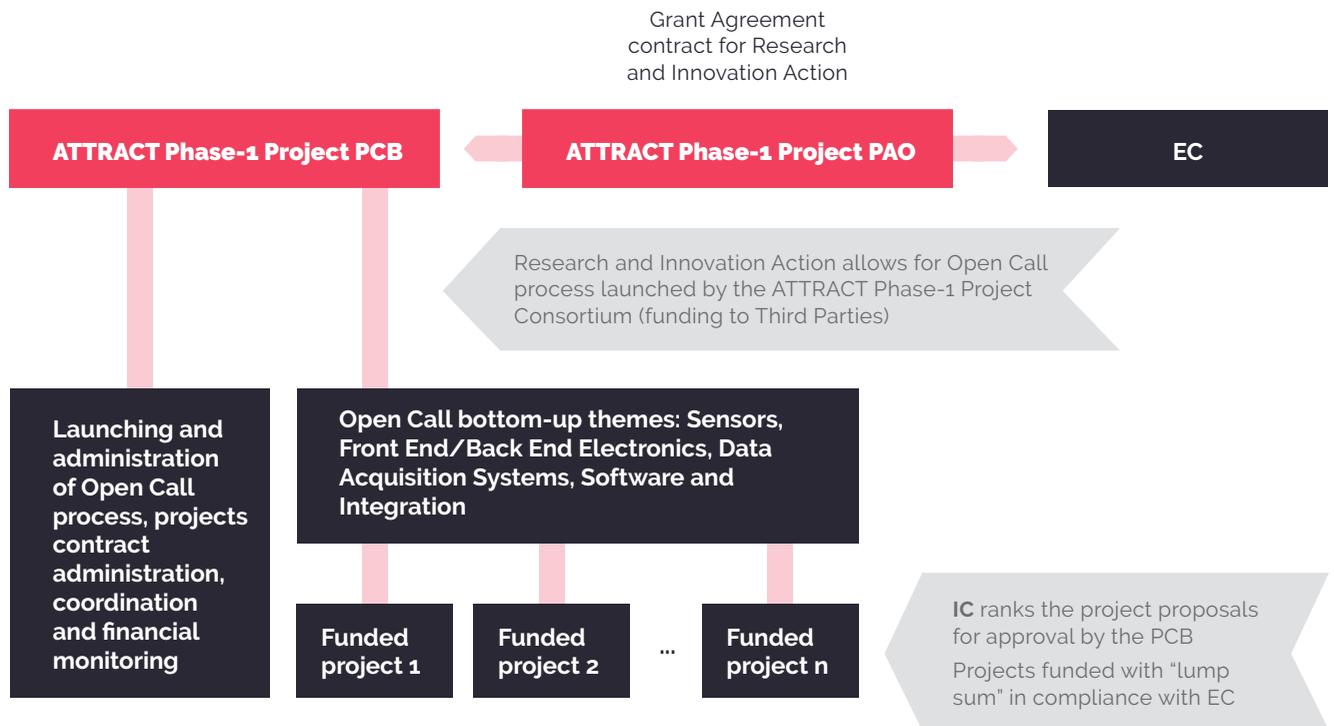


Figure 9: Summary of the ATTRACT Phase-1 Project funding mechanism.

5 | End of project

One year after the start of the funded projects, each team will be asked to present its technical results and an initial business concept at the ATTRACT Phase-1 Project Final Assessment Conference. The IC will judge each presentation on technical excellence as well as on societal relevance, technological development potential and scope for commercial exploitation. The Final Assessment Conference will enable the invited corporate and private investment communities to recognise projects with the potential for further up-scaling to higher TRLs.

After preparation by the PAO with support of the IC and PAC, the ATTRACT Phase-1 Project PCB will submit a full and detailed report on the evaluation of this seed-funding mechanism to the EC, with options for sustaining the seed-funding programme and further up-scaling of breakthrough innovations³⁰.

Private investors may wish to participate during the development of the ATTRACT Phase-1 Open Call proposals or the execution of the funded projects following ATTRACT Phase-1. Private investors can enter the ATTRACT Programme’s innovation cycle at various points (e.g. in either or both Phases, although it will be rather unlikely in ATTRACT Phase-1), depending on their profile (corporate investor, venture capitalist, Business Angel) since the purpose of the ATTRACT Programme is to move breakthrough technology concepts quickly up the TRL ladder. The funding mechanism in ATTRACT Phase-2 will allow various forms of investment, on a project level, in an SME participating in a project, or as a corporate investment. Figure 10 below shows some of these entry points for potential investors:

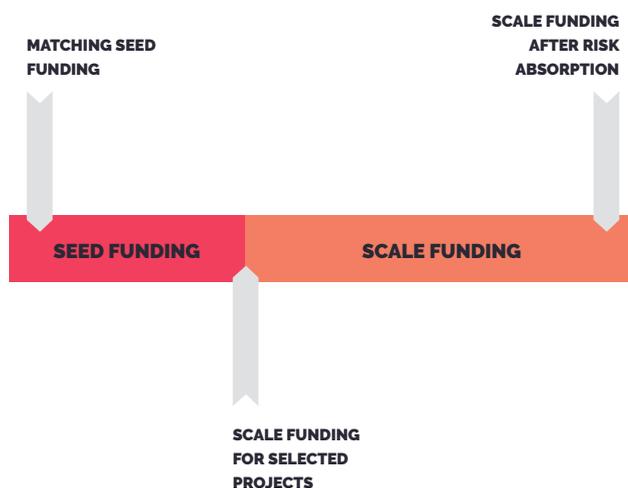


Figure 10: The envisioned ATTRACT Programme allows entry points for private investment (e.g. Business Angels, Venture Capital, corporate investment etc.) at any stage following the ATTRACT Phase-1 Project. This Figure does not specifically take into account other forms of engagement such as gifts, or funding a sub-contractor making a vital part.

³⁰ As mentioned in the main text, the envisioned ATTRACT Phase 2 (within H2020) and the ATTRACT Programme (FPg).

PROCESS

The ATTRACT Phase-1 Project will operate through six interlinked Work Packages (WPs), and one Project Management WP. Figure 11 below shows the work packages, after which the activities of WPs 2-7 are summarised.

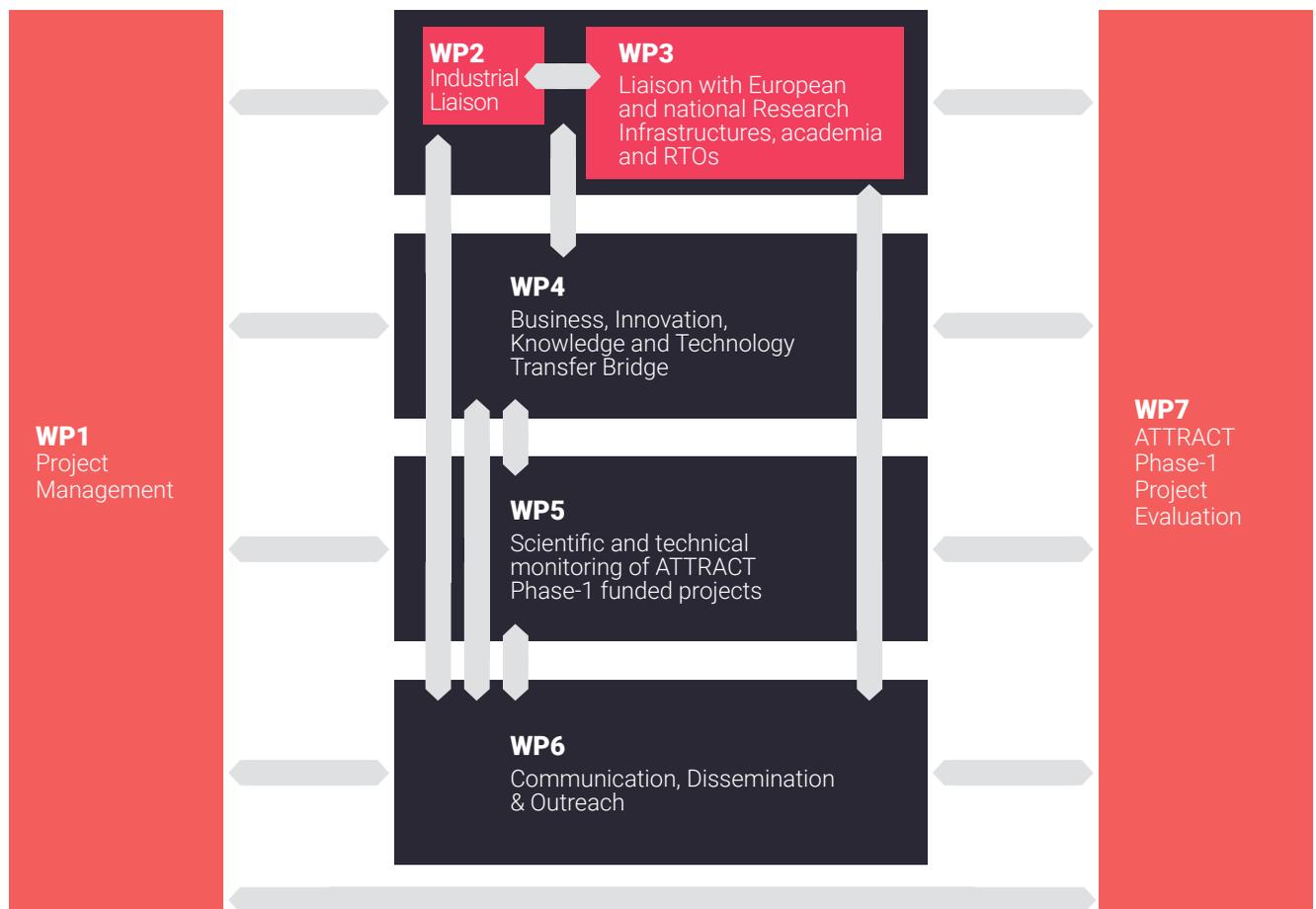


Figure 11: Overview of interlinked WPs for organising, funding and managing the ATTRACT Phase-1 Open Call.

WPs 2 and 3 each focus on a specific target audience for the identification of technology ideas that may have breakthrough societal and industrial potential. These target groups are:

- WP2: large industry; SMEs and private investment communities, including venture-capital firms, Business Angels;
- WP3: European and national RIs, academic centres and RTOs through their TTO offices.

Each of these WPs will frame messages for their audience and use existing networks to promote participation in the ATTRACT Phase-1 Open Call. It is clear that there will be overlaps and synergies between these audiences. This is unavoidable, as some industries also have strategic investment objectives, some academic organisations have SME spin-out targets and RIs will already work with industry and SMEs in technology development. This means that the WPs will closely co-ordinate the types and content of communications and the approach to specific audiences. Each WP will – from their target audience – help WP6 provide speakers and specialists to support

dissemination events and local, regional and global outreach activities as well as communications to national research policy makers. The WPs will also provide input to WP7 on the criteria to determine from each of the target audiences whether ATTRACT – as a Programme – is successful in identifying and promoting high-risk scientific ideas toward a TRL that makes them alluring for industry and investors. The input will help to streamline the approach to move projects further up the TRL ladder.

WP4 will run the ‘Young Innovator & Entrepreneurs’ Pilot’ in which MSc students will be encouraged to use Design Thinking methodologies to imagine and develop new societally relevant product or service concepts based on a selection of various technologies featured in the ATTRACT Phase-1 Open Call funded projects. WP4 will also deliver the dissemination and outreach activities for the ATTRACT Phase-1 Project and will furnish scientists in the 170 ATTRACT Phase-1 funded projects with a basic knowledge/ better grasp of entrepreneurship.

WP5 will focus on monitoring the scientific and technical progress and output of the awarded projects. If irregularities in the execution of awarded projects are found, WP5 will inform the PCB via the PAO.



WP6. The outreach and dissemination activities differ from the work already mentioned to encourage various target audiences to participate in the Open Call. WP6 will inform and promote the results of the ATTRACT Phase-1 Project as a highly efficient platform for exploring breakthrough ideas that would otherwise not undergo further development. WP6 will also provide support to those funded Open Call project consortia members who might be interested in becoming future entrepreneurs and/or want expertise on how to further scale up their technology to higher TRLs. This will be done through training in making investment pitches to prepare them for future meetings with private or corporate investors interested in taking breakthrough technologies to market. These training sessions will focus on the acquisition of skills, techniques and ideas that effectively convey what participants' projects/technologies have to offer. Outreach activities at local, regional and national level will take place (through existing outreach programmes by the Phase-1 Project Consortium partners) to help businesses and policy makers grasp how industrial participation in the Open Call and the transfer of knowledge can boost regional and national economic growth and what the focus should/could be in national research agendas to further strengthen regional specialisation.

WP7 will evaluate and validate the results of ATTRACT Phase-1 Project as a model for continuous co-innovation of high-risk breakthrough project concepts. It will draw up the (periodic) evaluation reports from WP2, WP3, WP5 and WP6 and use the Key Performance Indicators (KPI) from WPs 2-3 and the assessments from the IC and the PAC as well as the ATTRACT Phase-1 Consortium's Project PCB and external stakeholders to (further) refine the model toward sustainability (for example, moving the funded projects higher up the TRL ladder). WP7 will also provide insight on how the ATTRACT Phase-1 model (and even the Programme) could be transferred to other science domains.

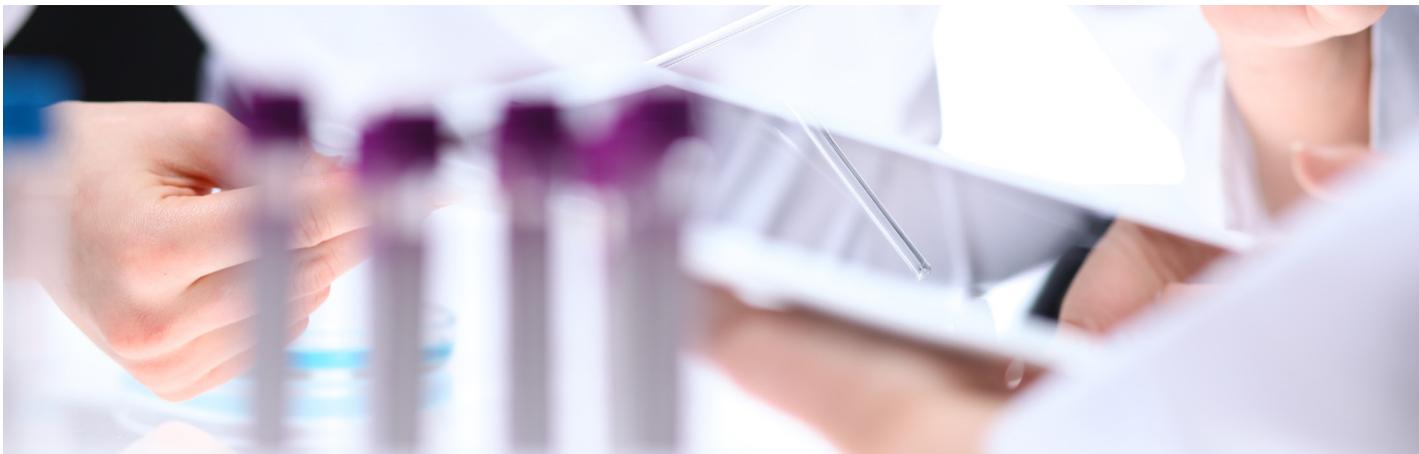


Figure 12 below shows the timeline of the ATTRACT Phase-1 Project activities. The launch of the Open Call right at the start is an option. This is because the Consortium members discussed all aspects of the Open Call implementation in detail as part of the development of the H2020 ATTRACT Phase-1 proposal. As part of their commitment and In Kind Contribution (IKC), the following preparatory implementation actions with regards to the Open Call have therefore already been defined, agreed and/or developed:

- > Draft templates for proposal submission and evaluation criteria and guidelines.
- > The content and legal consistency of the TPPAs.
- > The online proposal submission system.

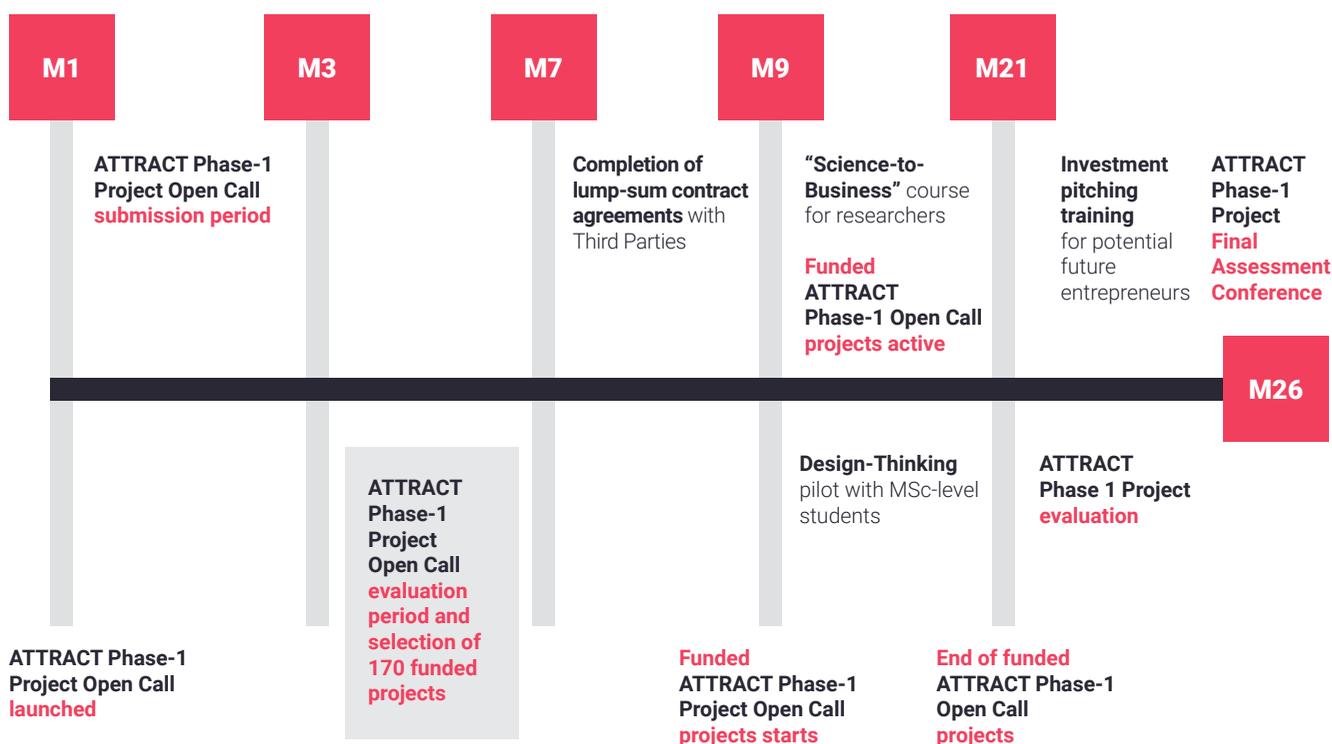


Figure 12: Overall timeline of project activities. Original proposal.

6

PROPOSAL FOR ATTRACT PHASE-2
PROJECT AND THE UP-SCALING
OF THE ATTRACT PROGRAMME

To create breakthrough innovations that have a real impact on the many societal issues that face us globally, radical ideas must be given time to gestate and be tried in a setting in which risks can be taken and risk entertained. The ATTRACT Programme Consortium expects that no more than 4-to-6 out of every 100 ideas submitted in the ATTRACT Phase-1 Open Call will have the potential to transform society. As discussed earlier, it is out of the small number of really potent ideas that large societal and economic benefits arise. ATTRACT Phase-1 can be seen as a way of fishing these ideas out of a deep pool.

The scientists (academic and industrial scientists alike) who create these breakthrough ideas will mostly be engaged in basic science projects and will use ATTRACT Phase-1 as a means to test a novel idea and whether it could also have other uses. It is important to understand that the end-results of ATTRACT Phase-1 funded projects are still a long way from the market. What the ATTRACT Phase-1 Project does is start a cycle that will cut the time to create and develop a technology by up to 50% compared with traditional pathways (see Figure 13 below). In other words: the ATTRACT Phase-1 Project absorbs initial (industrial) investment risk to try unproven tracks that might lead to the next big innovation.

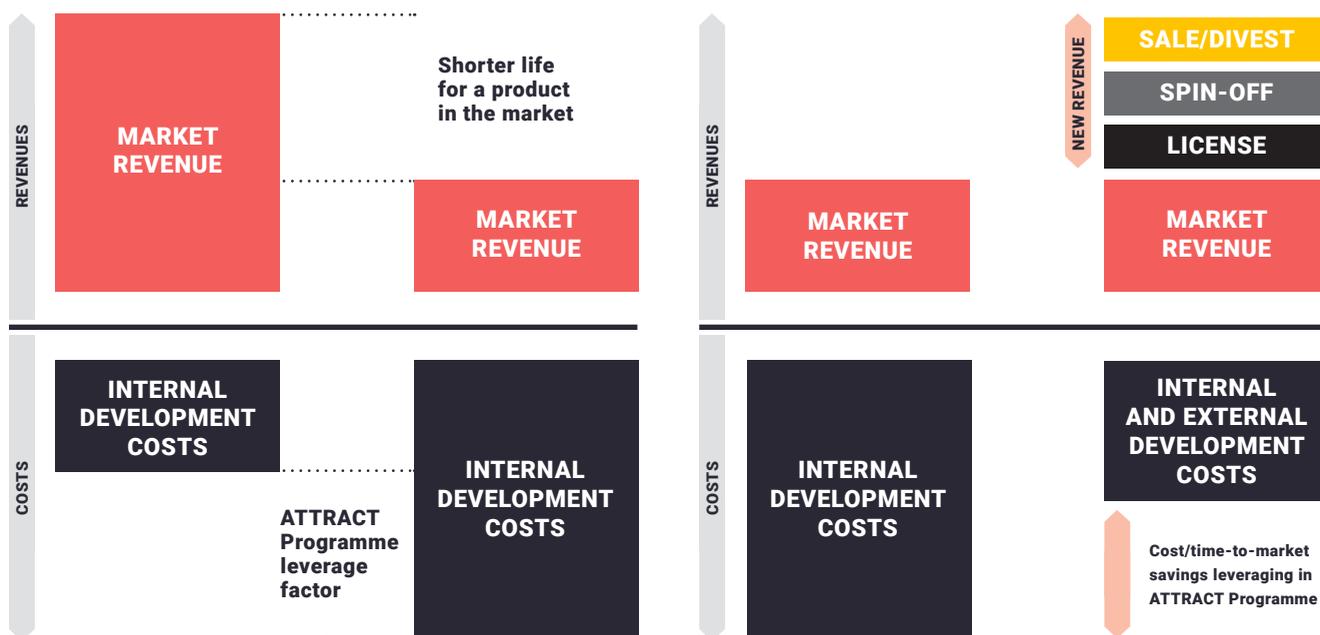


Figure 13: One can explore, test, and validate the market potential for specific applications much faster by building on technologies originally developed for fundamental science projects. This will slash internal and external development costs for companies and allow a faster time-to-market. In particular, SMEs will benefit by reducing the need for costly in-house research.

The ATTRACT Phase-1 Project alone will generate a set of technology results that will have moved from a 'wild idea' to a validated technology proposition, but whose market applicability is still largely unclear. It is unlikely that an industrial or private investor would already be prepared to assume the financial risk to up-scale these ideas or prototypes, given their - still - very speculative nature and potential. Investors will also know that although it will still be the same scientists who will have to lead up-scaling work, they are unlikely to be interested in (or necessarily good at) moving the technology to the point where a more traditional product development cycle can be started.

Another step is needed for radical ideas that make it through the ATTRACT Phase-1 Project process and put them on the path towards real world, products and services relevant to society. This is what we call the envisioned ATTRACT Phase-2 Project (which is not the subject of this proposal). It centres on a stepwise reduction of investment risk as the identified technologies move higher up the TRL-ladder (TRL 5-8), revealing potentially valuable applications. As the technology moves up this ladder, the clearer it will become where interesting applications might develop. This is the stage at which point investors will start to create professional eco-systems to capture the value of these ideas.

The ATTRACT Phase-2 Project can be summarised as a public financial instrument allowing radical technologies to develop into future innovations which address key societal needs. It enables ideas developed in the ATTRACT Phase-1 Project to withstand the pressure of having to compete immediately with other – faster but also more incrementally oriented – investment projects. The ATTRACT Phase-2 Project is a specific approach to bridging the so-called 'Valley of Death' for breakthrough technologies that – by their very nature – need more time to come to fruition.

The ATTRACT Phase-2 Project is currently seen by the ATTRACT Programme Consortium as a further proposal to be submitted under the H2020 2018-2020 Work Programme, where it would provide the financial up-scaling mechanism to some 6-8 validated ATTRACT Phase-1 Project technologies.

There are plenty of modern-day applications (see Table 2 below) that offer evidence how RI-generated technology has found its way into our society. Some examples are listed in the table below. As has been argued from the start of this proposal, this transition has taken place by pure chance, not through a systematic approach. The true value of the whole proposed ATTRACT Programme therefore lies in the intrinsic synergy of ATTRACT Phase-1 and ATTRACT Phase-2. Here, partners in the ATTRACT

Programme Consortium have modelled its global potential. **Their simulations suggest that over a period of ten years, nurturing and supporting up to 600 radical science-driven innovation projects in ATTRACT (within a budget envelope of €2 billion of public and private funding) would achieve an economic multiplication factor of 10 or more.**

Table 2: Examples of modern-day applications that originate from RI technology developed for fundamental science projects.

Some modern-day applications <i>(not specifically selected for Societal Need, but to demonstrate the relationship with RI technology development)</i>	Originating RI technology for fundamental science projects
A quarter of the world's 20 most-used drugs were developed using synchrotrons. Examples: malaria, flu and AIDS treatments.	Synchrotron research.
Over 20,000 MRI scanners used in hospitals around the world.	Superconducting cable (multi-cored Rutherford cable) for use in high field magnets for particle physics experiments (e.g. the Delphi and H1 solenoids).
Cordless vacuum cleaners.	Portable, self-contained drill capable of extracting core samples from below the lunar surface (NASA project, developed by Black & Decker).
Detection of bed bugs in hotel bedrooms.	Analysis of gases on the comet 69P/Churyumov-Gerasimenko.
'Bionic Ear' (cochlear implant).	Development of electronic sensing systems, telemetry, sounds and vibrations sensors in the Space Shuttle programme.
Wireless communication (WiFi).	Australian astronomers studying radiation from Black Holes.
Modern Bio-Pharma industry (estimate: for every \$1 public investment, the return has been \$141 in the economy ³¹).	The Human Genome project.
World Wide Web.	Automatic information-sharing between scientists in universities and institutes around the world.

³¹ http://www.battelle.org/docs/default-document-library/economic_impact_of_the_human_genome_project.pdf.

The envisioned ATTRACT Programme will involve multiple iterations of the ATTRACT Phase-1 and ATTRACT Phase-2 Projects, to enable a continuous cycle of selecting and nurturing breakthrough science, and facilitating the development of its results into breakthrough innovations. Within the ATTRACT Phase-1 Project, WP7 will produce a final report on the envisioned structure and mechanisms for the ATTRACT Programme. Although it is hard to say what they are now, the Consortium can outline some of the key initial ingredients that the ATTRACT Programme may contain:

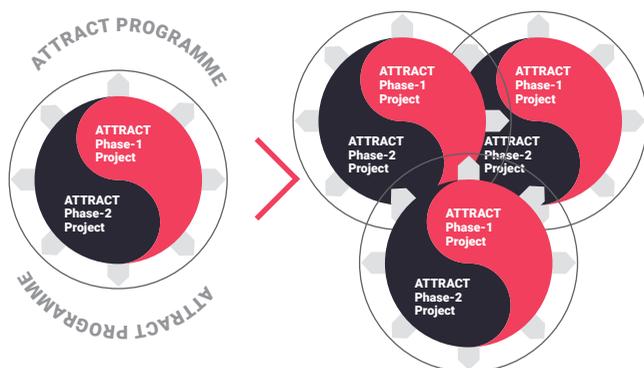
- The notion of co-innovation as a mechanism to balance collaboration and competition.
- The paradigm from ‘Open Science to Open Innovation and Open to the World’ as the overarching concept.
- The synergy of public funding with private funding to absorb and mitigate the risks that breakthrough technologies face as they progress towards the market.

Identifying the conceptual and operational backbone of the envisioned ATTRACT Programme could lead to a sustainable ecosystem model applicable to other technology realms beyond Detection and Imaging (see Figure 14 below).

For Europe, the successful implementation and continuation of the ATTRACT Programme will result in greater synergy and return on their investment in the 600+ national and pan-European RI infrastructures (€2,488 billion under Horizon 2020, multiplied many-fold by member-state facilities and co-funding), as well as a tangible instrument to create stronger ties between all types of knowledge-intensive industries and publicly-funded knowledge institutions. The institutionalisation of collaborations between industry and RIs (and the wider academic research communities) will help slash costs and allow industry to carry out the necessary (fundamental research) and shorten the time taken to create the innovations that Society and the world need.

The implementation of the ATTRACT Programme is seen by the current Consortium as part of the next EU Research Framework Programme (i.e. FP9). The Consortium considers that once the ATTRACT Phase-1 and ATTRACT Phase-2 Projects have proven themselves as breakthrough innovation generators to industrial and private investment communities across the world, a new, lasting, innovation eco-system will evolve between RIs, academic centres, RO and industry (see Figure 19 below). Achieving this will see a gradual reduction in demand for public funding to perpetuate the cycle.

Figure 14: Illustration of the natural synergy between the ATTRACT Phase-1 and ATTRACT Phase-2 Projects, whereby the end-point of Phase-1 (identifying breakthrough technologies and absorbing investment risk) is the starting point for of Phase-2 (reducing investment-risk by public support to up-scale radical technologies on the path to breakthrough innovation, so that market forces can then take over). The model – called ATTRACT Programme – can be expanded to cover more projects in a given science domain, but it can also be extended to cover other key-enabling technologies in various science domains that may subsequently start to create their own synergies.



THE ATTRACT PHASE-1 PROJECT GOVERNANCE MODEL AND DECISION-MAKING PROCEDURES

The governance model has been set up to dovetail with the project's purpose as a seed-funding mechanism. It comprises a single layer, which is the Project Consortium Board (PCB). The PCB establishes two independent ad-hoc bodies:

- 1 | The Independent RDI Committee (IC).
- 2 | The Project Advisory Committee (PAC), whose internal composition is explained below.

The operational procedures for the PCB, including decision-making, conflict resolution and its relationship to the IC and the PAC, are described in the CA. The operational procedures for the IC and the PAC will be defined by themselves in order to ensure full independence.

The **PCB** manages the ATTRACT Phase-1 Project and is the ultimate decision-making body of the Phase-1 Project Consortium. Each Consortium partner will appoint one representative to the PCB. The PCB's principle tasks are to:

- > Steer the overall project.
- > Confirm the composition of the IC members as selected by the IC Chair for the purpose of peer-reviewed evaluations in the specific domains that the proposals address; the PCB will not confirm if it has proven concerns as to the integrity or independence of an IC member or as regards the competence in relation to the technologies set out in the ATTRACT Phase-1 Open Call.
- > Make changes to the Consortium Plan if necessary.

- > Approve the list of projects for funding, as established by the IC.
- > Appoint the PAC Chair and appoint the other PAC members.
- > Confirm the replacement of PAC members in the event of non-performance or conflict of interest.

PCB meetings will be held at least twice a year. At its first meeting after the start of the Project (Effective Date), the PCB elects a chairperson from among its members. The first meeting of the PCB shall be chaired by the PCB Member appointed by the Co-ordinator. The Chair will invite the other PCB members to a meeting and will also prepare the meeting's agenda.

PCB decision-making: The best way of reaching agreement within the PCB is through consensus. In principle, a PCB meeting decision is only valid if all nine partner organisations have attended the meeting (quorum) and the Minutes of the meeting have been approved. If the quorum is not reached, the PCB Chair will set a new meeting date within 15 days. If the quorum is still not reached, then decisions can be taken by a two-thirds majority vote without the full quorum being reached. Each Phase-1 Project Consortium partner organisation has one vote. PCB decisions may also be taken without a physical PCB meeting, provided the Chair has circulated a written document to all Phase-1 Project Consortium partners and full consensus is achieved. The Project Co-ordinator will advise the PCB Chair and organise the logistics of the PCB meetings (including taking the Minutes). The detailed operational procedures of the PCB are described in the CA.

The following representatives from the Phase-1 Project Consortium partner organisations will be members of the PCB:

Table 3: Overview of ATTRACT Phase-1 Project PCB members

NAME	ORGANISATION	POSITION
Thierry Lagrange	1/ CERN	Head of Industry, Procurement and Knowledge Transfer.
Luke Collins	2 /EIRMA	EIRMA Rapporteur.
Andrew McCarthy	3/ EMBL	Team Leader (Synchrotron Crystallography) at the EMBL-Grenoble.
Michael Krisch	4/ ESRF	Head of Division – Instrumentation Services & Development Division.
Kalevi Ekman	5/ AALTO	Professor of integrated product development and machine design at AALTO University & Director of AALTO University Design Factory.
Paolo Mutti	6/ ILL	Head of Instrument Control Division.
Jonathan Wareham	7/ ESADE	Dean (Faculty & Research) of Business & Law Schools.
Thomas Tschentscher	8/ XFEL	Scientific Director.
Mark Casali	9/ ESO	Head of Technology Development.

The **IC** is the ad-hoc external body for (Table 6):

- > The preparation of the contents for the ATTRACT Phase-1 Open Call.
- > The evaluation of the received project proposals.
- > The ranking for funding for the ATTRACT Phase-1 Consortium.

It is a fully independent committee of top-level experts in the domain of Detector & Imaging technology from science, industry and the private investor community. The Chair of the IC will remain the same throughout to ensure continuity and consistency. The PCB has appointed the IC Chair: Professor Sergio Bertolucci of the University of Bologna. All IC Members will sign a letter of appointment, including the mandate for their tasks and provisions on the prevention of conflicts of interest of the IC Members arising from economic interests, or political or national affinity.

The IC will not have representatives of the ATTRACT Phase-1 Consortium organisations (nor of any legally affiliated entity) to avoid any bias toward Call Themes, specific applicant consortia or individual evaluations. The IC has the following responsibilities:

- > Establish RDI topics for the Open Call, based on the already described bottom-up approach with different Detection & Imaging technology communities across Europe in accordance with the project's objectives as set out in the Grant Agreement.
- > Evaluate and rank submitted ATTRACT Phase-1 Open Call proposals, recommend their selection to the PCB for funding by the ATTRACT Phase-1 Consortium.
- > Contribute to the follow-up of funded projects (in close collaboration with other WPs) to ensure excellence throughout these projects' duration.

Ranking of evaluated proposals will be achieved through consensus, save where in exceptional cases agreement cannot be reached. If there is a tie (for example on the bottom two proposals eligible for funding), then the IC-Chair has the deciding vote.



The Co-ordinator is the intermediary between the ATTRACT Phase-1 Consortium and the EC as the Funding Authority for the ATTRACT Phase-1 Project.

The Project Coordinator (PC) for the ATTRACT Phase-1 Project is Markus Nordberg.

As the former Resources Co-ordinator of the ATLAS Experiment at CERN (2001-2013), Nordberg has wide experience of implementing (very) large international collaborations and managing complex financial programmes with many stakeholders. Furthermore, Nordberg has been responsible for the initiation of several CERN-led EU-funded projects in FP7 and H2020, has co-created IdeaSquare innovation centre at CERN, and is a regular speaker on the future of Europe's Research Infrastructures at EC events in Brussels. Nordberg will be assisted by Pablo Garcia Tello, head of the section of EU (European Union) strategic initiatives at CERN. Tello has extensive experience in co-ordinating EC projects such as COOPERATEUS, SUNJET, NEARS and AERA-PRO among others. In the past, he has also contributed to the creation of the EC Public Private Partnership SPIRE. The responsibilities of the Coordinator are:

1 | Toward the Consortium partners:

- > Monitoring the Consortium partners' compliance with their obligations.
- > Transmitting documents and information connected with the ATTRACT Phase-1 Project to all Consortium partners.
- > Collecting and reviewing financial and technical progress data for the submission of periodic reports to evidence project deliverables and provide specific requested documents to the EC.
- > Administering the financial contribution of the EC to the Consortium partners and fulfilling the project's financial, legal and project management tasks vis-à-vis the EC.

2 | Toward the day-to-day operation of the ATTRACT Phase-1 Project as a seed-funding mechanism:

- > Managing the PAO.
- > Concluding TPPA with successful ATTRACT Phase-1 Open Call applicants on behalf of the Consortium partners³².
- > Distributing the funding to ATTRACT Open Call applicants (as 'Third-Parties').
- > Acting as the legal point of contact for the projects funded by the ATTRACT Phase-1 Project.

³² In case the Co-ordinator (i.c. CERN) is selected for a Third-Party contract, a different ATTRACT Phase-1 Project Consortium partner will sign the TPPA on behalf of the other Consortium members.

The **PAO** is the dedicated administrative body for the delivery of the ATTRACT Phase-1 Project. It is physically located at the offices of the Co-ordinator. The PAO will:

- > Manage all technical and administrative processes related to the publication of the ATTRACT Phase-1 Open Call and the electronic submission of proposals (Including acting as helpdesk for applicants).
- > Assist the IC during the evaluation process and notify applicants of the evaluation outcomes (following ranking approval by the PCB).
- > Develop the TPPA template and negotiate and prepare templates for signature between the PC and the successful ATTRACT Phase-1 Open Call applicants (e.g. the 'Third-Parties').
- > Organise the financial distribution of the allocated funds to the successful ATTRACT Phase-1 Open Call applicants (e.g. 'Third-Parties').
- > Support the individual WPs in the delivery of their tasks in building networks, communicating and disseminating information about the funded projects and the ATTRACT Phase-1 Project approach and the analysis of impact.
- > Provide administrative and logistic assistance to the PCB, PAC and IC upon their request, including the organisation of Consortium and PAC meetings, preparation of minutes and of IC evaluation sessions.
- > Prepare all required financial and technical progress reports to the EC, except for those reports that are assigned to the WP participants under the WPs as deliverables.
- > Assist the Co-ordinator in his/her role as the point of contact for the EC.
- > Assistance to the Consortium partners in their obligations with respect to communication and exploitation of the Project deliverables under the Grant Agreement. This includes co-ordination of communication between the TTOs and the Communication Departments of the Consortium ERI.
- > Assistance to the Consortium in the organisation of events, including workshops and conferences.

The PAO is staffed by experts employed by the co-ordinating organisation and has a proven track record in managing large international research projects (Table 4):

Table 4: Overview of ATTRACT Phase-1 Project PAO members

NAME	ORGANISATION	POSITION
Markus Nordberg	1/ CERN	Co-ordinator. Head of Resources Development, Development and Innovation (IPT-DI).
Marzio Nessi	1/ CERN	Advisor. Leader of the Neutrino Platform.
Sandy Petitfrere	1/ CERN	Administrative Assistant.
Pablo Tello	1/ CERN	Co-ordinator. Section Head of the Development of EU Projects & Initiatives within the CERN EU Support Group.

The **PAC** consists of representatives of European public and private entities. The PCB has appointed Professor John Wood from the Association of Commonwealth Universities as the Chair of the PAC for the duration of the ATTRACT Phase-1 Project. The Chair has already selected the other PAC members and these have been appointed by the PCB. The PAC Chair may invite external advisers as needed. For example: The PAC may invite Prof. Henry Chesbrough, who coined the term “Open Innovation” and Director of the Open Innovation Program at the University of California - Berkeley’s Haas Business School, for advice on the implementation of the Open Innovation principles in relation to the up-scaling of the ATTRACT Phase-1 Project to the full-scale ATTRACT Programme.

All PAC Members will sign a letter of appointment before the Grant Agreement is concluded. The tasks of the PAC are to provide strategic advice on a possible extension of the ATTRACT Phase-1 Project beyond its envisaged term. In providing such advice, the PAC may establish an open dialogue with public and private stakeholders, including high-level policy makers, to raise their interest in making follow-on investments to the ATTRACT Phase-1 Project.

The PAC will report on its progress to the PCB on a regular basis and as requested by the PCB. Table 5 presents an overview of the members of the PAC.

Table 5: Overview of members of the PAC

NAME	ORGANISATION & POSITION	RELEVANCE FOR ATTRACT PHASE-1 PROJECT
John Wood	PAC Chair	<ul style="list-style-type: none"> - Former Secretary General of the Association of Commonwealth Universities (ACU), former Chair of the first ESFRI Roadmap; - Former Chair of European XFEL International Steering Committee; - Former Chief Executive of the Council of Central Laboratories (UK Research Council); - Chair of the Global Research Data Alliance; - Chair of the South African Research Infrastructure Roadmap Group.
Monica Beltrametti	Director, Naverlabs	Former Chief Services Research Officer, Xerox, Vice-President of the Xerox Innovation Group and Director of the Xerox Research Centre Europe (XRCE). She supported and created ventures that were later acquired by companies such as SAP and EMC.
Sergio Bertolucci	Chair of the IC; Professor, at the University of Bologna	Currently member of the Restricted Panel of the European Committee for Future Accelerators. Formerly also Vice-President and a member of the Board of the Italian National Institute of Nuclear Physics.
Francisco Javier Cáceres	Director General, INEUSTAR (Spanish Association for Scientific Industry)	International Senior Consultant in the field of innovation and advises on new processes, models and tools. He was also Director of R&D at IESA, a company based in San Sebastian, and has been Director General of the Basque Country Association of Electronic and Information Technologies.

NAME	ORGANISATION & POSITION	RELEVANCE FOR ATTRACT PHASE-1 PROJECT
Leopold Demiddeleer	Strategic Advisor	<p>Dr. Léopold Demiddeleer, Ph.D., is the President of the Board at the European Industrial Research Management Association. Dr. Demiddeleer served as Senior Executive Vice-President of Future Businesses, Future Businesses Director and Co-Chairman of the New Business Board and the Corporate R&D at Solvay S.A. He joined Solvay in 1981. He has also served as the New Business Development Director at Solvay since 2001. From 1981 to 2001, he was responsible for several research and development initiatives in catalyst high performance materials, polyethylene, polymers and global polyolefins. He started his career in 1976 teaching Mathematics and Physics. He served as a Director of Corporate R&D and New Business Development at Solvay Specialty Polymers Italy S.p.A. He has been an Independent Director of McPhy Energy SA since May 22, 2015. Dr. Demiddeleer is a Member of Advisory Board at Conduit Ventures Limited. He served as a Director of Polytronics, Inc. He served as the Chairman of the Supervisory Board at McPhy Energy SA. He was a Member of Advisory Board at Pangaea Ventures Ltd. Dr. Demiddeleer holds a Ph.D. in Physical Chemistry from Brussels University.</p>
Candace Johnson	President, EBAN (European Business Angels Network)	<p>Co-founder of SES, the world's pre-eminent satellite group and the architect of SES Global. She is also the founding President of Europe Online Investments, the world's first internet-based online service and satellite broadband network, and the founder of Loral Cyberstar-Teleport Europe, Europe's first independent private trans-border satellite communications network. She is the founding President of VATM, the Association of Private Telecom Operators in Germany, and of the Global Telecom Women's Network.</p>
Gernot Spiegelberg	Senior Principal, Industrial Data Space, SIEMENS AG	<p>Since May 2008, Gernot Spiegelberg has headed as Vice President Siemens AG's Lighthouse Project eCar in the company's central research. Previously, in his role as Executive Vice President and CTO, Spiegelberg bore global responsibility for group Strategy / Technology at Siemens VDO Automotive AG. Spiegelberg holds a doctorate in engineering and an honorary professorship and teaching position at the Technical University of Budapest. He has held a variety of management positions in industry, including 18 years at Daimler-Chrysler where he was responsible for global advance development in mechatronics. Gernot Spiegelberg is selected as a Rudolf-Diesel-Industry Senior Fellow at the Technical University of Munich since July 2010. In Siemens his focus today are smart services in IoT with smart autonomous agents and Industrial Data Space IDS. Parallel he is busy at the University of Skt. Gallen for "disruptive business models" and shares several BoM gremia in automotive and automation domain.</p>

NAME	ORGANISATION & POSITION	RELEVANCE FOR ATTRACT PHASE-1 PROJECT
Daria Tataj	Strategy Advisor, Board Member and entrepreneur	Daria Tataj is a Strategy Advisor, Board Member and entrepreneur. She has over 20 years of business and public policy experience in emerging markets and in the most advanced global knowledge economies. Dr. Tataj is the Chairwoman of High-Level Advisors to Carlos Moedas, the EU Commissioner for Research, Science and Innovation. She also advises the World Economic Forum, multinational companies, governments, investors and high-potential teams. The CEO of TATAJ Innovation, a strategy and investment firm, she founded the company with a mission to help cities build innovation districts.
Patrick Terroir	President of Innovation Legal, Chair of the LESI Patent and Technology Licensing Committee, Legal Advisor	Patrick graduated from Sciences Po, University of Paris II (doctorate in law) and the National School of High Administration. He occupied several positions in French public administration, in the Ministry of Economy and Finances and the Caisse des Dépôts. In 2006, he set up an innovation department in CDC, which operated in the patent economy, technology transfers from universities and SME support and created France Brevets. Since February 2014, Patrick Terroir, became a lawyer and created Innovation Legal, which is active in innovation and the intellectual property economy. He tendered advice for several European programmes and chairs the Patent and Technology Licensing Committee of Licensing Executive Society International since May 2015. Patrick Terroir is also a teacher in Innovation Economics at Sciences Po, Paris and wrote several articles and reports (among them: "Creating new infrastructure and a new mode of functioning for a true knowledge economy in Europe", Europartenaires Report, January 2013, "Rebalancing the Patent Economy", IAM review, March 2014, "The SMEs and the patent challenge", Special issue of Les Nouvelles (LESI), September 2017).

Table 6: IC Members

IC MEMBER	IC FUNCTION
Sergio Bertolucci	Chair
Cinzia da Via	Co-ordinator
Ricardo Graciani Diaz	Member
Michel Spiro	Member
Andrea Cuomo	Member
Matthias Kaiserswerth	Member
Ralf Kaiser	Member
Norbert Wermes	Member
Bernd Schmitt	Member
Pawel Sobkowicz	Member
Dimitra Darambara	Member
SiJbren Otto	Member

Figure 15 below summarises the ATTRACT Phase-1 Project governance structure:

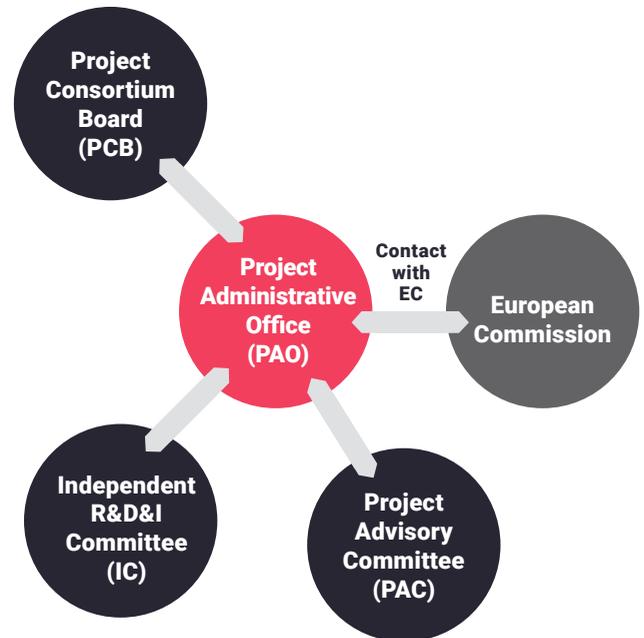


Figure 15: ATTRACT Phase-1 Project governance structure.

THE ATTRACT PROGRAMME



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