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Bringing industry and science closer together to solve industrial and societal challenges

A guide on how to empower Commercial Analytical Research Organisations

DRAFT

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For decades policy practitioners around the globe have agreed on the ambition that industry and academic science should cooperate more closely to speed up the process of finding innovative answers to pressing problems of society. And as we currently experience worldwide: it has never been more urgent to foster this interaction of different actors than today. Solving societal challenges, like the current Covid-19 pandemic or the leaps in technology we need to tackle problems related to climate changes, requires **a fast translation of scientific advances or even breakthroughs into innovative remedies, products and processes**. Therefore, to be agile and fast to market there needs to be a stronger link between the creators of scientific insights and those actors serving the market.

A lot of policy action has been taken on national as well as supranational level throughout the past years to build this stronger link and support tighter collaboration: regional thematic clusters have been founded, innovative project consortia have received financial support through a multitude of channels and also a lot of investment instruments have been introduced to foster innovative start-ups that are built on scientific expertise - just to mention a few.

However, as it is stated in conceptual work towards HORIZON EUROPE:

“While benefitting from world-class research and strong industries Europe can do better at transforming this into leadership in innovation and entrepreneurship.”¹

Bringing industry and science closer together....

The current situation shows the necessities for a strategic rethink to force the pace and implementation of this aspired transformation towards innovation leadership with a view to Europe, particularly with a focus on infection research, life and material science.

Competence in these different scientific areas already exists at large Research Technology Organizations (RTOs like Fraunhofer in Germany or DTI in Denmark), in universities, and research infrastructures or directly in companies. However, by supporting small, agile, and dedicated service providers, the competence will be made available to an even wider range of industrial sectors, and the current need to bridge gaps within the research and innovation system can be addressed in a more efficient, cost-effective and anticipatory manner. That’s why we suggest empowering a group of actors that fulfill this role and thus complement and support the existing players.

¹ Please refer to:

https://ec.europa.eu/info/sites/info/files/research_and_innovation/strategy_on_research_and_innovation/presentations/horizon_europe_en_investing_to_shape_our_future.pdf, slide 4, online last access 03.07.2020

These actors come in a number of guises like intermediaries, mediators, service providers, contract research organization (CRO) or commercial analytical research organization (CARO)². But despite these different titles – as a systemic actor serving the innovation system as a whole –they have a few characteristics in common:

They are profit-seeking micro and small sized private companies acting as an intermediary or mediator between research infrastructures and industrial customers, providing targeted support, consultation and advice based on (analytical) research and measurement services in a variety of technological and scientific fields on a contractual basis.

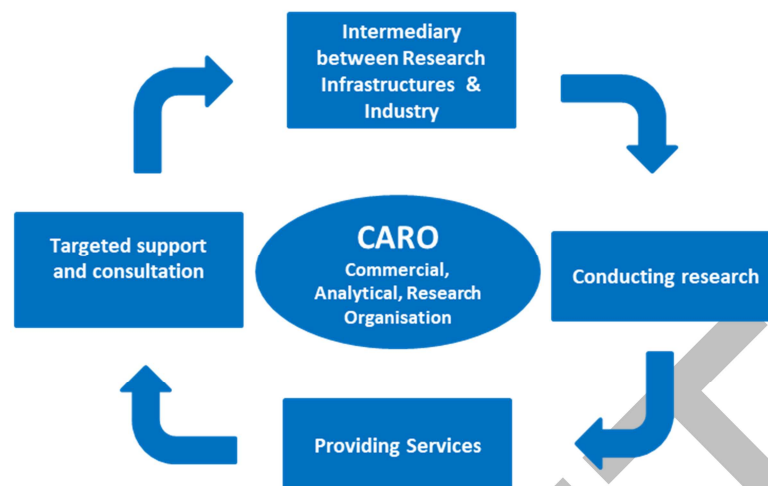
Therefore, the roles and tasks they take on and are performing are manifold:

- They act as innovative **problem solvers and facilitate applicable tailor-made solutions to industrial and societal challenges** involving industry and academia. Lowering the burden for businesses (particularly SMEs) to get in touch with research infrastructures and being knowledgeable about research instruments and methods are key features of their competence. They easily meet industry's interests in confidentiality and in concluding straightforward contracts on industry terms while advancing applied science through method development as well as real knowledge and technology transfer.
- They act as **executors of scientific expertise and “ambassadors” for research potential and facilities** by e.g. carrying out measurements and experiments with their own staff at research facilities. Thus they **unburden the classic science sector** with regard to staff capacity and academic key activities like publishing (through taking over acquisition, supervision and hands on support of industrial customers by carrying out time-intensive services and applied research activities) as well as storage, curation, modeling, analysis and interpretation of data.
- They act as **translators and educators of methods, results and data by interpreting scientific insights** for their industrial customers. This way they enable businesses (particularly SMEs) to even tap into the world of research and broadening their knowledge to be turned into new products or processes and thus are drivers of productivity. Furthermore through trainings and seminars for customers and employees they broaden the knowledge base and help to reduce skills shortage.
- Through all this, they act as **accelerators for innovation** by providing businesses with much quicker yet complete assistance in (analytical) research through targeted and nuanced application of conventional and advanced characterisation of e.g. ingredients or materials and speed up research and development in areas like New Materials, Nano Technology or Life Sciences.

² Please refer to:

https://www.carots.eu/sites/sites_custom/site_carots/content/e114136/e114157/CAROMarketanalysis.pdf

CARO tasks in the innovation system



Source: own sketch

...by acknowledging the role of Commercial Analytical Research Organizations CAROs

Most CAROs are highly specialized in a certain research area, material system or measuring method. As a **“hinge” between research and business** they conduct experiments and measurements with very diverse scientific counterparts such as laboratories at universities, synchrotron radiation or neutron-beam facilities or free electron laser (just to name a few), but also work together with businesses with very different backgrounds. Due to their high degree of specialization they are internationally sought-after, as they act as absolute specialist experts in their area. In parallel their role and position in their region is a key lever in **value creation** within several areas of **regional economic development** (e.g. tax flow, providing highly skilled jobs, avoiding brain drain) as well as knowledge transfer (e.g. establishing international as well as local networks and acting as local role models). CAROs can also foster the development and competitiveness of local companies that access their services and are often their very first customer.

Against the background of mostly temporary employment in science, CAROs can offer unlimited **career opportunities for scientists** in their home region and be particularly attractive for those combining raising a family and working as a scientist. Most of the jobs for CAROs are “challenging research puzzles” and the employees can remain connected to science and need to master skills “beyond mass production”.

Since CAROs often use research equipment of third parties they remain flexible and bind less capital, thus taking the paradigm of the **“sharing economy”** to an advanced level. This way existing (mostly publicly financed) resources are used more intensively and can even be co-financed by paying industrial customers that rely on confidentiality.

The effort of universities, research infrastructures and companies to obtain and support these CAROs is comparably low, since the employees of the CAROs generally know the equipment and analytical methods and use them repeatedly. There have even been instances when scientists from CAROs were asked by the research entity to act as the ones responsible for the instruments, educating guest researchers etc. since their scientist are the ones who use the instrumentation in the most variable way adapting them to individual needs.

What challenges do Commercial Analytical Research Organizations face?

According to research on CAROs³ there are very few established businesses in this area of expertise⁴ in Europe so far. Because of the rather traditional set ups of the science and innovation systems, CAROs have hardly been visible to investors, funding agencies and politicians alike. But as pointed out above:

***they might just be the change agent Europe needs right now
to enhance its innovation capacity!***

As with every innovative start-up though: the founding phase and scaling up the young business by employing more staff and ensuring costumers is challenging⁵. Most CAROs have been set up by scientists (turned entrepreneurs) with their own capital and show slow organic growth. As empirical research has revealed⁶, venture capitalists show no interest in investing in the CARO business model since it is primarily built on services that stem from (analytical) research and cannot easily be scaled up. Credit financing for corporate growth (without additional private securities) fails due to the lack of collateral in the company since they generally do not own tangible assets (e.g. measuring instruments or immaterial property rights).

How to empower Commercial Analytical Research Organizations?

Taking different geographical scopes of the research and innovation system heuristic as a starting point for possible activities to empower CAROs, different stakeholder can be involved and take action:

Regional support

- Cooperating with CAROs is a great opportunity for research facilities to foster innovation, broaden their general impact and pay tribute to the often requested outreach to industrial and societal actors. Since most research infrastructures are dedicated to enable “excellent science” though, and access to laboratories or other facilities like synchrotrons is mostly granted after proposals have been successfully rated by scientific indicators, we need to **explore different avenues and alternative criteria for accessing research infrastructure**, acknowledging e.g. socio-economic effects and regional development aspects, to enable timely cooperation with industrial partners like CAROs. Obviously this efforts needs to be accompanied by practical and organisational solutions on availability of beam time, laboratory access etc..
- In a joint effort of a dedicated research infrastructure, regional authorities and selected industrial stakeholders a pilot activity could be launched to explore the benefits, challenges and pitfalls of a **regional partnership to support CAROs**. Coming up with practical “hands on tools” on how to overcome obstacles to joint collaboration of research actors with CAROs (tools might include a database indicating rare vacancies at facilities that might be taken up by external users, committing staff by the facility to solely serving industrial customers or even the establishment of a dedicated

³ By an international team of representatives of large research infrastructures, funding agencies, universities and foundations within the CAROTS project funded by INTERREG, for more information please consult: <https://www.carots.eu/>

⁴ With a focus on the analytical methods like spectroscopy, tomography, scattering and diffraction mainly operating in the disciplines of solid state physics, solid state chemistry, crystallography

⁵ Please find the SWOT analysis in Chapter 6 of the Market Analysis: https://www.carots.eu/sites/sites_custom/site_carots/content/e114136/e114157/CAROMarketanalysis.pdf

⁶ A report on the topic of financing CAROs will be published on our website shortly

PhD or post-doc programme involving businesses that are willing to co-finance a scholar seeking to investigate a research challenge for them who is ultimately aiming at starting a CARO him or herself).

National support

- Several European member states have policy instruments on national level in place that support the innovativeness of companies in general by offering tax reduction if R&D is carried out or by paying for consulting regarding exploring new markets. But there are **no dedicated instruments that foster the role of mediator companies** who could act as comprehensive nodes of the innovation system.
- A few instruments have beneficial side effects on CAROs like the German “Central Innovation Programme for small and medium-sized enterprises (SMEs)”⁷ (ZIM) or the Swedish “Research infrastructure – utilisation and collaboration programme”. The latter promotes industrial access to research with synchrotron radiation, neutron-beam and Free Electron Laser with significant funding amounts⁸ and might be **a blueprint for a policy support scheme** that is arranged by a public authority in accordance with research infrastructures’ needs and possibilities for cooperation.

European and international support

- At European level there is great potential for integrating a **dedicated support scheme** for CAROs into Pillar III (Innovative Europe) of **HORIZON EUROPE**. This scheme might include start-up and growth funding for CAROs⁹: together with an industrial partner, who is seeking scientific expertise the CARO could apply for financial support to pay for access to research facilities¹⁰. The scheme¹¹ should aim at supporting a critical number of new players as well as established ones, mainly in the field of materials and life sciences to kick start a knowledge partnership of CAROs that are capable to carry out a multitude of different methods, serve different branches and address a multitude of challenges¹².
- Due to the small number of existing CAROs, most of the founders are “lone fighters” and could profit from a **dedicated network**¹³. This could facilitate cooperation and generate synergies between existing CAROs by increasing visibility. By sharing knowledge within a network, CAROs might profit from each other in terms of joint training and coaching (on scientific techniques as well as managerial skills), the exchange of costumers due to different specialisation with regards to methods or materials and they might be able to speak with one voice trying to overcome systemic challenges in close cooperation with research and industry.

⁷ For more information please consult: <https://www.zim.de/ZIM/Navigation/DE/Meta/Englisch/englisch.html>

⁸ For more information please consult: <https://www.vinnova.se/en/calls-for-proposals/research-infrastructure-utilisation-and-collaboration/industrial-pilot-projects-autumn-2019/>

⁹ There might be different financial support quotas for young and established CAROs and obviously de minimis rules need to be applied.

¹⁰ After studying the national landscape of policy instruments in selected EU countries and Russia as well as EU funding schemes like the Open Innovation Test Bed

https://ec.europa.eu/research/participants/data/ref/h2020/other/guides_for_applicants/h2020-im-ac-innotestbeds-18-20_en.pdf, we realized that a dedicated supranational policy instrument on EU level to foster innovation through supporting intermediary companies is missing and might be worth considering. Please find our report here: <https://www.carots.eu/publications/>

¹¹ In terms of the potential set up, budget and outreach of such a scheme fostered by the European Commission and commissioned by a Research Infrastructure please see the ATTRACT initiative as an illustrative example: <https://attract-eu.com/the-project/>

¹² Since Germany with its recent history of pushing for systemic research and innovation policy through the Hightech Strategy is currently chairing the EU Council, this is a great opportunity to point out the innovative role of CAROs in the search for innovative solutions to overcome the COVID-19 pandemic and address its socioeconomic consequences]].

¹³ For more news on the network we will be updating our website regularly: <https://www.carots.eu/>

And finally...

...let the people have their say: thoughts by CAROs

“Our venture or better adventure of funding our CARO came about from the frustration of performing commercial research within the university environment. Whilst universities are very good at their core function as educators and leading research in new and emerging fields, they are not always well placed to respond and meet the requirements of industry – here one of the key issues is speed. As an SME focused on providing such services, we can very quickly respond to industrial needs.” *Simon Jacques, CEO of Finden Ltd, UK.*

“Industry meets lots of technological challenges and some of them need to be solved with a scientific approach. To build the path from the technical issue to the scientific resolution, a global view and high-level scientific skills are necessary. That is what my CARO offers in a multidomain expertise (New Materials, Nano Technology and Life Sciences): finding the appropriate scientific solution to the technical demand from an industrial client and targeting the scientific analysis so that it can be easily implemented by industrial engineers. We act as a one-stop-shop for industrials: seeking for large scale facilities that propose the adapted experimental techniques, contacting scientists, managing teams for experiments and customizing result analysis for industrial needs.” *Sophie Bouat, CEO of Science-S.A.V.E.D, France.*

“We help our clients with fundamentals for the strategic decisions they have to make. That fundament is based on understanding something, for example, how an ingredient will work or a product should be processed, but also on understanding the true context and your client. To give advice, you must really try to understand not only the science but also the commercial context, to try to be in your clients shoes. This takes time and effort, time that academic researchers often do not have. We unburden researchers at universities or larger RI like synchrotrons with this task. We also unburden them with the task of saying “no thanks” to projects where they cannot publish and they can still retain a good relation. We unburden them with the discussions about the data long after the project has been performed. We unburden them with the responsibility of saying what the data means for the real situation, of answering although not all is known, of giving advice based on far from 100% complete picture. Because for us, this is the fun part.” *Anna Stenstam, CEO of CR Competence, Sweden*

“Teaming up with complementary intermediaries to be able to provide complete and more attractive services would help, for example a match between broader R&D management type intermediaries and data analysis and measurement experts for certain techniques. In the long term, possibly to form joint business alliances would be helpful as well as concretizing the role of intermediaries and the needs for them. Also to create awareness about it in the industrial synchrotron radiation community, like university scientists, synchrotron radiation facilities, large national research organizations, industrial potential customers.” *Mårten Edwards, CEO of Uppsala Synchrotron AB, Sweden.*

...and thoughts about CAROs

“If we increase the percentage of proprietary beam time, as policy makers and funding agencies expect us to, this will lead to a much increased workload for scientific staff who is supposed to run the beamlines. The measurements have to be conducted and – being more time consuming – for industrial customers the raw data have to be analyzed. Depending on method and problem, this can take up to one or two weeks. For the research facility it means either to hire dedicated industry service staff or, even better, cooperate with a CARO.” Marc Thiry, Industrial Liaison Officer at HZG Center for Material and Coastal Research, Germany.

“CR has brought great insights and value to real world problems in our product development cycle. They have a great balance of being focused on the end product and also bring best in class scientific thinking and approaches.” Eric Johnson, P&G Beauty, US, testimonial on working with CR Competence, Sweden

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