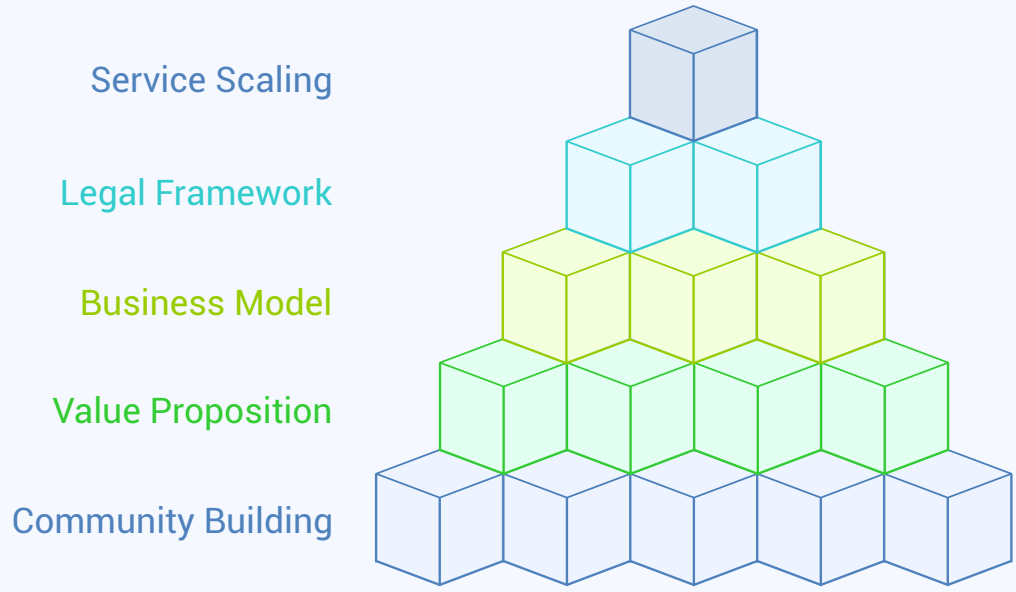
GUIDANCE AND BEST PRACTICES FOR EUROPEAN CENTRES OF EXCELLENCE IN HIGH PERFORMANCE COMPUTING AIMING TO BUILD THEIR COMMERCIALISATION CAPABILITIES



WHITE PAPER

JULY 2025

EXECUTIVE SUMMARY

High-Performance Computing (HPC) Centres of Excellence (CoEs) are central to the European Union's strategy for scientific excellence and technological sovereignty. Initially created to enhance computing research capabilities across domains such as climate, health, energy, and engineering, CoEs are now aiming to develop beyond research-focused consortia to drive commercial impact of their results and ensure potential long-term CoE self-sustainability.

To do this effectively, CoEs must develop as customer-focused service providers that offer well-defined value propositions tailored to various stakeholders, including researchers, small and medium-sized enterprises (SMEs) and large enterprises. This requires the identification and transformation of Key Exploitable Results (KERs) into market-ready outcomes and the development of targeted services based on software platforms, consulting, or training. The maturity of these services must be evaluated using frameworks like Technology Readiness Levels (TRLs), while commercialisation strategies should take into account intellectual property management, pricing, legal frameworks, and customer relationships. Building a successful innovation and commercialisation ecosystem around the CoE will require instruments such as the Business Model Canvas and will rely on the skills and commitment of individuals engaged in business development, marketing, and legal operations, along with the formation of strategic alliances and support from external advisors. CoEs have the potential to serve as powerful catalysts for innovation, providing a unified scientific and economic benefit throughout Europe.

This paper presents best practices, tools and strategic insights to help CoEs develop and build their innovation and commercial capabilities and is the first step in establishing solutions for CoE sustainability based on replicable models for commercialisation of CoE results. The information is designed for CoE coordinators, innovation managers, business developers, and policymakers who support applied innovation in European research and is relevant to anyone participating in IT-relevant Horizon Europe Research and Innovation Actions (RIAs).

ABOUT CENTRES OF EXCELLENCE

THIS SECTION INTRODUCES THE MISSION AND EVOLUTION OF HPC CENTRES OF EXCELLENCE IN EUROPE AND EXPLAINS THE IMPORTANCE OF BUILDING COMMERCIALLY-ORIENTED CAPABILITIES FOR RESEARCH-DRIVEN CONSORTIA.

HPC CoEs are central to the EU's investment in computational science, uniting advanced applications and architectures with mission-driven goals across domains such as materials science, weather and climate, life sciences, and engineering.

They bring together a consortium of top-tier universities, research institutions, supercomputing centres and industrial partners to innovate and address strategic challenges in science, technology, and engineering to achieve the long term economic, societal and environmental goals set out by the European Commission. CoE activities are centered around; **software development, co-design with users, and training & skills development**.

Since 2015, 27 CoEs have been funded through Horizon 2020 and the EuroHPC JU, with a combined investment of approximately €140 million. Currently, 14 CoEs are active and will continue through 2026 with a call for further funding recently advertised. To ensure commercial impact of their results and long-term sustainability, CoEs must design and implement new operational models capable of generating revenue, partner continuity, and supporting stable service delivery.

***Commercialisation** is not about replacing research objectives with profit objectives, but rather, it is about expanding the scope and impact of the CoEs by developing and offering services that solve concrete industrial problems.*

Whether through training, workflow development, consulting, or integrated software support, CoEs have potential to provide high-value services to the European industrial base yet lack the appropriate mechanisms and expertise to handle intellectual property, revenue sharing and bridge the gap between generation of exploitable results and deployment of mature commercial services.

The guidance presented here supports CoEs aiming to expand their capabilities beyond publicly funded collaborative research projects to entities capable of delivering scalable, market-oriented services.

STAKEHOLDERS AND VALUE PROPOSITION

THIS SECTION HIGHLIGHTS HOW COMMUNITY BUILDING AND UNDERSTANDING USER NEEDS ARE ESSENTIAL TO SHAPING A STRONG VALUE PROPOSITION FOR COMMERCIAL SERVICES

The impact and long-term sustainability of CoEs depends heavily on identifying, engaging, and serving a diverse range of target groups:

- **Scientific communities:** researchers, HPC developers, software engineers and academic consortia which contribute to the development, validation and dissemination of software tools, models and frameworks.
- **Industry:** startups, SMEs, mid-caps and large industrial players are crucial users and co-designers of CoE services which are engaged through pilot projects, licensing agreements and consulting contracts.
- **Strategic Innovation partners:** Digital Innovation Hubs (DIHs), National Competence Centres (NCCs), technology transfer offices (TTOs), Innovation Management Department and incubators facilitate the exploitation and commercialisation of CoE outputs. Here the approach will vary depending on whether these partners are internal or external to the CoE and whether the support would incur an additional cost.
- **Policy Makers and Public Authorities:** regional and national governments, civil protection agencies and EU-level bodies can be influenced by CoE outputs for informed decision-making, particularly in areas such as climate resilience, health, and public safety.
- **Civil Society and NGOs:** These groups often benefit indirectly through improved public services and data-driven governance. They also contribute to ensuring the ethical and socially responsible development of CoE innovations and can provide valuable feedback related to the quality of services.

Offering commercial services requires more than technical excellence. Understanding who potential customers are, what they need, and how CoE activities can support them is critical to success. Target group engagement and community building should be treated as strategic functions, not just communication tasks, to help CoEs stay visible, relevant, and aligned with market needs. Initiatives like CASTIEL2 already promote this exchange, and joint activities such as **User Days, workshops, and shared trainings** are effective ways to connect with industry. Early engagement through **pilot projects, use cases, or co-design** builds trust and ensures services respond to real needs.

A central pillar of service development is a clear, differentiated **Unique Value Proposition (UVP)**. Defined through interviews, co-creation, market consultations, and pilots, the UVP guides scope, pricing, documentation, and partnerships. It should balance the CoE's mission with customer needs. Each CoE will have a UVP based on its nature.

*The **Unique Value Proposition** (UVP) is a foundational concept in commercial service development. The UVP identifies something of value which can be provided to a customer and which others cannot provide. The UVP can be identified by answering three key questions:*

1. *What is the specific problem or need addressed?*
2. *What is the innovative service or result being proposed?*
3. *What are the measurable benefits for the customer?*

IDENTIFICATION AND DEVELOPMENT OF SERVICE OFFERINGS

THIS SECTION EXPLAINS HOW TO TRANSITION FROM PROPOSED VALUE TO CONCRETE SERVICE OFFERINGS FOR CUSTOMERS

To turn a compelling UVP into tangible services, CoEs need structured development, and this is where **Innovation Management** bridges research outcomes and viable offerings. While multiple methodologies and frameworks exist, the core idea is to identify, assess, and mature **Key Exploitable Results (KERs)** to ensure services are technically robust and market-aligned. CoEs should have access to Innovation Management support, potentially appointing their own innovations managers to ensure a better fit between their expertise and that of the CoE. Tailored support services for Horizon-funded projects such as the Horizon Results Booster (HRB) aim to bring research results closer to market and can be of use.

The following activities are key to developing viable service offerings (Figure 1):

- **Identification of KERs:** identify the results with potential for use beyond the project and validate the novelty and stakeholder demand.
- **Exploitation strategy:** for each KER it is important to define the readiness level; the exploitation form, e.g. licensing, SaaS, etc.; the target users and sectors, IP ownership and freedom to operate; partnerships required to scale and deliver the service.
- **Business plan development:** each CoE should develop a business plan for selected KERs (see next section).
- **Go-to-market strategy:** is a key component of the business plan and will help to engage early adopters, gather feedback, refine services and build capacity for support, scaling and operations.

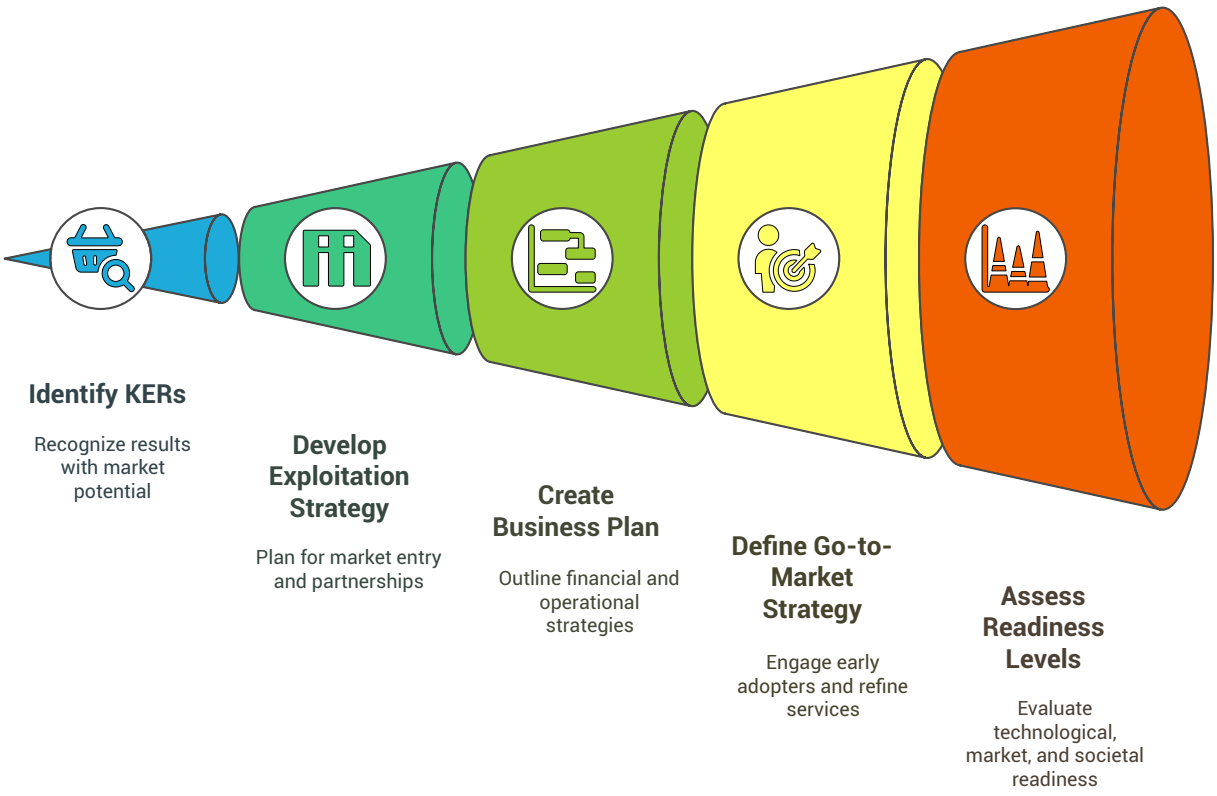


Figure 1: *Development of service offerings by Centres of Excellence. In practice these key activities will not necessarily be carried out sequentially and, in particular, the assessment of readiness levels will be conducted on an ongoing basis.*

Defining the readiness level of each KER is critical to understanding how and when to engage with potential customers and involves applying a number of readiness level frameworks to assess and guide progress:

- **Technology Readiness Level (TRL):** Measure technological maturity, from basic principles (TRL 1) to system-proven in operational environment (TRL 9).
- **Market Readiness Level (MRL):** Assess market maturity and demand alignment, from early market insight (MRL 1) to validated business models and early adopters (MRL 9).
- **Societal Readiness Level (SRL):** Evaluate societal acceptance and impact, especially in areas involving public trust, ethics, and regulation.
- **Investment Readiness Level (IRL):** Used to assess whether an innovation is ready to attract external funding or venture investment.

Additional dimensions such as Team Readiness, Customer Readiness, Business Model Readiness, legal and IP Readiness and Funding Readiness have been developed (KTH Innovation Readiness Level Framework) but TRLs are the most common and widely used criteria (see Table 1). Advancing service offerings to higher TRLs requires continuous improvement involving the implementation of structured feedback mechanisms, e.g. surveys and advisory boards, and iterative testing.

Table 1: *Technology Readiness Level definitions, implementation and use. The table highlights generic descriptions for each TRL tier and includes examples of potential services or products and customer profiles for each. If the demand for a particular technology is high it is not uncommon for industry to engage at TRL 1-2 as early adopters.*

TECHNOLOGY READINESS LEVEL (TRL)	DESCRIPTION	POTENTIAL SERVICES OR PRODUCTS	TYPICAL CUSTOMER PROFILE
TRL 1-2	Basic principles and applied research	Research papers, workshops, awareness training	Academia, research institutions
TRL 3-4	Proof of concept and lab validation	Feasibility studies, early access programs, co - development projects	R&D departments in SMEs and industry, early adopters
TRL 5-6	Prototype development and testing in relevant environment	Consulting, pre - commercial pilots, tailored workflow services	Industrial pilot partners, system integrators
TRL 7-8	System prototype demonstration in operational environment	Beta services, licensing offers, custom integration and deployment	Commercial partners, public institutions
TRL 9	Actual system proven in operational environment	Full commercial service offerings, SaaS platforms, user support, SLAs	Enterprise customers, full -scale adopters

Irrespective of the sector, application or use case being addressed by the CoE, we consider the following as the main generic service offering options:

- **Software support and training:** from basic support and training to more advanced development of custom software features or workflows for specific use cases, co-development and consulting.
- **Software platforms (SaaS):** pay-per-use access and support to cloud-based simulation or analytics tools.
- **Passive revenue streams:** from existing or new software and training products, e.g. subscriptions and licensing, or digital media channel monetization.
- **Licensed software:** for commercial use which is free of any open-source software viral issues.

BUSINESS MODEL AND PLAN

THIS SECTION COVERS THE DEVELOPMENT OF A BUSINESS MODEL AND PLAN BASED ON UNDERSTANDING THE VALUE PROPOSITION AND WHAT CAN BE OFFERED TO CUSTOMERS. IT HIGHLIGHTS COMMON LEGAL ENTITIES AND WHAT TO CONSIDER WHEN MAKING A CHOICE.

*The **Business Model Canvas** (BMC) is a visual template used by entrepreneurs to develop an idea into an operating business. The BMC identifies nine interconnected business areas (blocks) which need to be developed for business success: Value propositions, Customer relationships, Channels, Customer segments, Key activities, Key partners, Key resources, Cost structure and Revenue streams.*

CoEs aiming to establish commercial operations require the definition of viable business models and plans to realise these. These models should not conflict with the CoE's mission while enabling revenue generation, stakeholder engagement, and legal and operational flexibility. While many CoEs operate within academic or public institutions, this should not prevent them from structuring business units, internal incubators, or legal entities capable of service delivery. The **Business Model Canvas (BMC)** first described by Osterwalder and Pigneur in 2010[1] is a commonly used template to prototype a business. The nine business blocks featured in the BMC can be consolidated into four focus areas which need to be developed in conjunction:

- **Offerings:** encompasses the previously described key concepts around value proposition, KERs and readiness; and the demand for these from a customer's perspective.
- **Customers:** requires understanding the volume and value of the market for the UVP and the type of customer involved.
- **Infrastructure:** requires definition of the resources and support network required to establish and operate the business and deliver the UVP through the offerings. Part of this is the creation of a legal entity to support commercial activities.
- **Finances:** requires definition of the income and cost streams to prioritise the business cost structure and involves defining a pricing model for the offerings.

[1] *Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Hoboken, NJ: Wiley.*

Setting up a legal entity is a key step for CoEs aiming to operate commercially and allows them to manage IP, enter contracts and create revenue. Common legal entity options in the EU are outlined in Table 2.

Table 2: *Common legal entity options in the EU.*

LEGAL FORM DESCRIPTION	JURISDICTION	SUITABLE FOR	EXAMPLES
International non - profit association	Belgium/EU law	Multi-country partnerships	AISBL (Belgium)
Limited liability company	National law	National CoEs aiming for commercial spin - offs	GmbH (Germany) BV (Netherlands) SL (Spain) Ltd (UK)
SCE (European Cooperative Society)	EU-wide	Cross-border stakeholder ventures	Transnational cooperative model
Non-profit Association	National law	Community-based R&D organisations	ASBL (Belgium and Luxembourg)
Foundation	Country-specific	Public-private cooperation	Entity for asset -based research and innovation

Making a choice on a legal form of incorporation involves understanding the above options but this must be combined with a structured approach combining legal, strategic and operational perspectives.

The criteria presented in Table 3 are highlighted to assist CoEs in identifying the most suitable structure based on operational goals, geographical scope, service complexity and sustainability ambitions.

Table 3: *Criteria to assist CoEs in choosing a legal form of incorporation. These criteria can be used as initial guidelines to choosing a legal form of incorporation and should be used in combination with legal counsel and input from all stakeholders involved in the CoE to ensure alignment with both strategic objectives and practical requirements.*

CRITERIA	DESCRIPTION
Cross-border operation	Ability to provide services and enter contracts across multiple EU countries with minimal legal obstacles.
Commercial service orientation	Suitability of the legal structure to offer paid services such as training, consulting, or licensing.
IP ownership and licensing	Capacity to hold intellectual property and manage flexible licensing agreements on behalf of the entity or its members.
Ease of incorporation	Simplicity, cost, and speed of establishing the legal entity under national or EU law.
Governance requirements	Level of complexity in internal decision-making structures (e.g., boards, general assemblies, audits).
Suitability for pilot services	Appropriateness of the entity to launch, test, and iterate early stage or small scale commercial offerings.
Funding eligibility	Ability to apply for and receive EU, national, or regional funding, including public grants and innovation programs.

A business or commercialisation plan goes beyond setting up a legal entity and will involve:

- **Organisation:** governance, operations and financial and administrative procedures for the legal entity will need to be established and supported.
- **Intellectual Property Rights management:** IP ownership is often retained by the individual CoE partner/s which created it and it is crucial that the legal entity has freedom to operate regarding any IP which is part of the commercial services to be offered.
- **Marketing and branding:** some CoEs already have a strong brand within their communities. However, specific materials will need to be created to advertise the business and its services.
- **Lead generation:** establishing a pipeline of commercial leads will be critical for success and part of this will involve having an established process for presenting and responding to commercial requests.
- **Customer relations:** establishing relationships and building trust with customers is critical for business success.

Establishing a 3-5 year strategic roadmap will be essential to establish commercially active CoEs. Further, CoEs are encouraged to collaborate with Strategic Innovation Partners but should also have internal capacity and expertise in Innovation Management and specifically in the following domains:

- **Business Development:** to help identify market opportunities, develop strategic partnerships and manage customer relationships. Competence in value-based selling, contract negotiation, and channel building is critical to ensure long-term sustainability.
- **Product Management:** to coordinate technical development with market expectations by defining service specifications, user requirements and go-to-market roadmaps.
- **Market Analysis:** to understand customer needs, market segmentation, competitive positioning and value communication. This includes skills in digital marketing, market research, and campaign execution targeting technical and non-technical stakeholders. Whether the language being used is technical, non-technical or business, CoEs need to have personnel which is fluent in all.

RECOMMENDATIONS

THIS SECTION HIGHLIGHTS SOME INSIGHTS BASED ON THE LESSONS LEARNED BY SOME OF THE CENTRES OF EXCELLENCE DURING THEIR COMMERCIALISATION JOURNEY.

A range of commercialisation experiences across multiple CoEs have led to shared insights that can guide future commercialisation efforts, e.g. **BioExcel** has engaged biotech SMEs in customizing workflows and licensing training access; **ESiWACE** has offered GPU optimisation consulting to meteorological organisations; **EXCELLERAT** has helped automotive suppliers integrate simulation workflows into digital twin platforms; **ChEESE** has delivered operational volcanic ash forecasts during a real eruption (La Palma), supporting civil protection decisions and airport operations; **HiDALGO2** has provided wind-comfort information by computational simulations for the entire city of Stockholm. While contexts vary by domain and maturity level, several common factors emerge as success enablers or barriers (Figure 2):

- **Team:** ensure there is a skilled, committed team supported by an Innovation Manager driving innovation and commercialisation. Consider pro-viding training to CoE partners to promote a more commercial mindset and engage external support from a Steering Committee or Advisory Board which is independent of the CoE.
- **Community:** successful CoEs develop services offerings like the those highlighted above by building active user communities through regular feedback cycles, forums, and user boards. This is especially key for open-source-based services, where users can become contributors and potential customers.

- **Piloting:** early and often. Engage industry early through pilot projects to validate software, refine services, and test IP/licensing models. Our experience shows that the development of uses cases and piloting is more successful when companies are engaged from an early stage, ideally at the Grant Agreement stage. This can to some extent also compensate for a lack of innovation management capabilities within the CoE and is more likely to deliver successful outcomes. Prioritise engagements with agile partners like SMEs.

- **Business operations:** commercial engagement requires establishment of business operations early on. Start lean through the use of e.g. a Memorandum of Understanding[2] (MoU) MoUs before formalising governance and services. CoEs that succeed in commercialisation either internalize these skills or access them through strategic partnerships.

In addition, a number of common challenges can be highlighted:

- **Governance Complexity:** balancing academic freedom with business account-ability.

- **Human Resource Gaps:** Limited availability of staff trained in business development and service delivery.

- **Funding Gaps:** Difficulty accessing venture or bridge funding during the post-project transition phase.

- **Partner Misalignment:** Differences in institutional priorities and risk appetite.

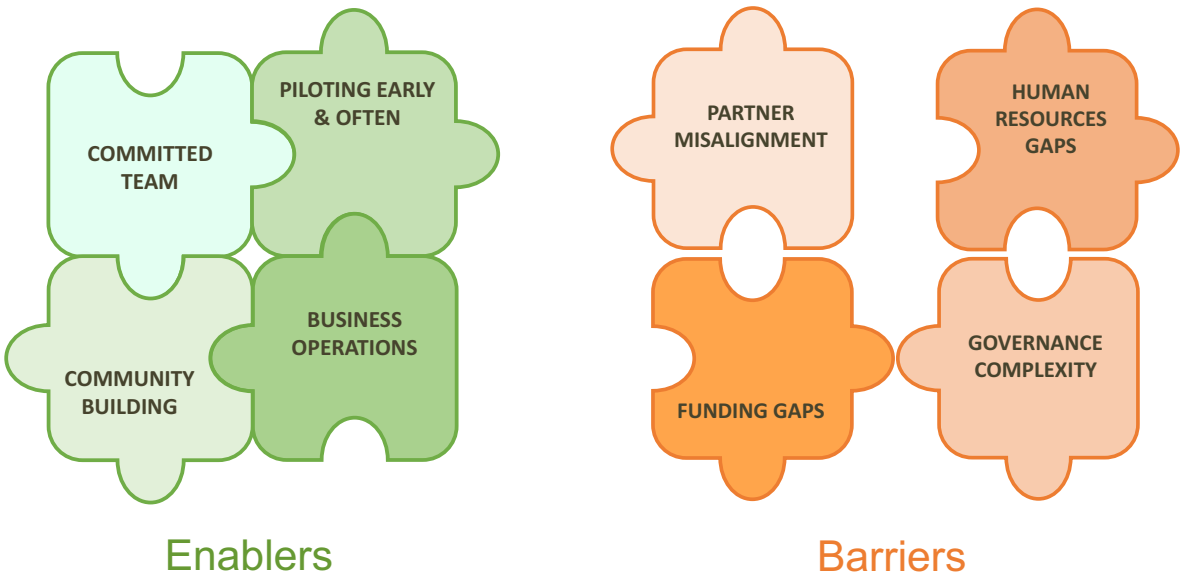


Figure 2: *Common enabling factors and barriers to commercialisation of CoE results.*

[2] *A MoU is a non-legally binding agreement between two or more parties that outlines their mutual intentions, roles, and responsibilities in a collaboration.*

FUTURE OUTLOOK

THIS SECTION HIGHLIGHTS SOME CONCLUSIONS AND SHARES A VISION FOR THE CENTRE OF EXCELLENCE ECOSYSTEM GOING FORWARD

Initially conceived as collaborative research consortia, CoEs must aim to become self-sustaining engines of innovation and achieve commercial impact. In this paper we highlight that this is not a binary choice between research and business, but a continuum, where commercial service development can coexist with open research goals, enabling broader reach and tangible economic benefit.

To enable this transformation, CoEs should build or access capabilities that go beyond scientific and HPC expertise: marketing, business development and legal; and embrace new competencies such as product and service development, stakeholder management, and operational governance. Looking ahead, a robust ecosystem for CoE commercialisation will include:

- Support for innovation and business development personnel,
- Dedicated funding lines for service piloting and incubation,
- Standardized frameworks for IP management,
- Templates for service packaging and communication,
- Shared platforms for promotion and user acquisition.

This paper highlights best practices, tools and strategic insights to help CoEs develop and build their innovation and commercial capabilities. As part of our ongoing work, we are looking to define specific guidelines and provide concrete solutions to ensure the commercialisation of results and the long-term sustainability of the CoEs. For this we aim to expand our activities and outreach, leveraging additional support from projects and initiatives such as CASTIEL-2 and FF+. The authors welcome relevant feedback and support as part of the next stage of this work (please scan the QR code at the bottom of the page).

Through collaboration, innovation, and focused investment in sustainability, CoEs can become permanent fixtures in Europe's research and innovation landscape, serving not only scientists, but industries, public institutions, and society at large.

Scan the QR code to share your feedback or become involved with our ongoing work.

AUTHORS

The authors are all associated with existing CoEs and contributed to the writing and design of this paper. They are members of the 'Sustainability Vision for CoEs Taskforce', which was born out of CASTIEL-2 WP4 activities.

Richard A. Norman

Independent Business Development and Innovation consultant at Norman Consulting and partner in the BioExcel CoE for Computational Biomolecular Research

LinkedIn: @richardanorman

Anne-Bernard Bedouet

Innovation, Product and Business Development Management at SICOS BW and partner in the EXCELLERAT P2 CoE for large-scale Simulation Workflows for Engineering Applications

LinkedIn: @annebernardbedouet

Alba Abia

EU Projects Innovation Officer at Barcelona Supercomputer Center (BSC) and partner in ESiWACE CoE for simulation of weather and climate in Europe

LinkedIn: @alba-abia

Marcin Lawenda

Senior Research Fellow at Poznan Supercomputing and Networking Center and partner in HiDALGO2 for credible environmental and social simulations

LinkedIn: @marcin-lawenda

Aerton Guimarães

Communications & Dissemination Officer at the Barcelona Supercomputing Center and partner in the ChEESE CoE for Exascale in Solid Earth Research

LinkedIn: @aertonguimaraes

Giulia Zunino

R&D Project Manager at HPCNow! (partner of Do It Now Group) and partner in the MultiXscale CoE for exascale-oriented application co-design and delivery for multiscale simulations

LinkedIn: @giulia-zunino86