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Industrial doctorates: strengthening Europe's research-industry talent pipelines

Evidence and recommendations from CESAER's 2024–2025 workstream on industrial doctorates

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Table of contents

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Rooted in advanced engineering education and research, CESAER is an international association of leading specialised and comprehensive universities with a strong science and technology profile that advocate, learn from each other and inspire debates. Our Members champion excellence in higher education, training, research and innovation, contribute to knowledge societies for a sustainable future and deliver significant scientific, economic, social and societal impact.

Executive summary

Industrial doctorates are emerging as a strategic instrument to strengthen Europe's research–innovation interface and to reinforce high-skilled talent pipelines across sectors. In a context of intensifying global competition for talent and innovation capacity, industrial doctorates offer a structured mechanism to align excellent research, advanced skills development and industrial absorption capacity. By embedding doctoral candidates in structured collaboration between universities and companies, they facilitate knowledge circulation, enhance intersectoral mobility, and contribute to Europe's competitiveness and resilience.

This report synthesises evidence gathered through CESAER's 2024–2025 workstream on industrial doctorates, including six new case studies from universities of science and technology, earlier analyses conducted by our Task Force Innovation, and insights from the workshop "Industrial doctorates: shaping the future of Europe's high-skilled workforce" held in Trondheim in May 2025.

Across diverse national frameworks, institutional models and sectoral contexts, several consistent findings emerge:

- **Diverse models, shared objectives:** Industrial doctorates take multiple forms — from nationally regulated schemes to university-led partnerships and European-level networks — yet they share core objectives: maintaining high academic standards, strengthening research–innovation linkages, and enhancing doctoral employability across sectors.
- **Academic quality:** Where supported by robust co-supervision, clear governance structures and well-defined assessment criteria, industrial doctorates can achieve academic quality equivalent to traditional PhD pathways. Clear delineation of roles between academic and industrial supervisors is essential.
- **Administrative complexity as a structural barrier:** Mixed funding models combining public and private contributions are common and often effective. However, fragmented national regulations, heavy reporting obligations and complex contractual arrangements — including employment status— limit scalability, especially for SMEs and cross-border cooperation.
- **Intellectual property and publication require early clarity:** Transparent, pre-agreed IP and confidentiality arrangements are critical to balancing open science principles with legitimate commercial interests. Delayed negotiation frequently generates tension and publication delays.
- **Career recognition remains uneven:** While industrial doctorates are valued within universities, broader employer recognition of doctoral competences beyond academia requires strengthening. Industrial doctorates should be embedded within wider research career frameworks at European and national levels.

At EU level, the Marie Skłodowska-Curie Actions (MSCA) provide a uniquely positioned instrument to scale high-quality industrial doctorates. However, industrial doctorates currently represent only a modest share of MSCA doctoral projects. Scaling their impact requires reinforced funding, enhanced flexibility, simplification of administrative requirements, and improved complementarity with national and regional schemes.

Industrial doctorates should not be understood merely as a specific programme format. They represent a systemic mechanism to integrate excellent research, innovation capacity and advanced skills development. With appropriate enabling frameworks, sustainable financing and mutual trust between academic and non-academic partners, industrial doctorates can play a central role in strengthening Europe's research base, talent ecosystems and long-term competitiveness.

While being beyond the scope of the present report, a direct comparison with the approach to industrial doctorates in China and in the US would be valuable for future work, particularly in light of the findings of the Draghi report on 'The future of European competitiveness'.

1. Introduction

Industrial doctorates are gaining increasing interest across Europe as universities, companies and policymakers look for more structured ways to connect excellent research with real-world challenges. They enable knowledge circulation across sectors, strengthen high-quality collaboration between academic and non-academic partners, and equip researchers with the skills needed in dynamic labour markets. For universities of science and technology, they are a powerful tool to deepen collaboration with industry and other non-academic partners, while maintaining robust academic standards.

In recent years, CESAER has examined how PhD candidates work with non-academic partners, including through industrial doctorates. In 2024, our Task Force Innovation, through its report 'Models of engagement for PhDs with non-academic partners', analysed practices across Europe and formulated recommendations to universities, industry, political leaders and EU institutions, based on case studies focused on 6 CESAER members. In parallel, our 2024 position 'Unleash full potential of Marie Skłodowska-Curie Actions' set out how MSCA can act as a trendsetter for research careers, including through industrial doctorates and other collaborative formats.

Building on this foundation, Task Force Learning & Teaching launched a focused workstream on industrial doctorates in 2024–2025. This workstream developed 6 new case studies that complement the earlier case studies from Task Force Innovation and gathered additional insights at the workshop "Industrial doctorates: shaping the future of Europe's high-skilled workforce" (Trondheim, 22 May 2025), kindly hosted by the Norwegian University of Science and Technology (NTNU). The workshop brought together university and doctoral school leaders, students, companies and European-level stakeholders, including European Commission's representative responsible for the Marie Skłodowska-Curie Actions (MSCA).

This input note summarises the main outcomes of that workstream, illustrates lessons from the new case studies and formulates recommendations to help EU institutions, member states and other stakeholders unlock the full potential of industrial doctorates.

2. Building on CESAER's previous work on industrial doctorates

Our earlier work in Task Force Innovation underscored that industrial doctorates are not a single model but a family of collaborative arrangements with non-academic partners. The 2024 report highlighted:

- the central importance of collaboration and co-creation with industry, SMEs and other non-academic partners;
- the diversity of legal and funding frameworks across member states;
- the critical role of high-quality supervision, research environments and clear intellectual property (IP) arrangements;
- the need for transparent expectations and support for PhD candidates navigating dual academic–industrial contexts;
- the added value of cohort-based approaches and centres or hubs, rather than isolated projects.

Our findings broadly confirm and reinforce the conclusions of the Task Force Innovation report. At the same time, they extend the analysis in three important ways.

- First, this report places strong emphasis on doctoral governance, supervision quality and the parity of academic standards between industrial and traditional PhDs;
- Second, it provides an explicit assessment of systemic barriers to scaling, including administrative burden, SME participation and fragmentation across member states;
- Third, it clearly situates industrial doctorates within the European policy context, particularly in relation to MSCA, research careers and Europe's competitiveness agenda.

3. Lessons from six case studies

We have developed case studies from six CESAER Member universities:

- Aalborg University, Denmark;
- Brno University of Technology, Czechia;
- Budapest University of Technology and Economics, Hungary;
- Gdańsk University of Technology, Poland;
- Politecnico di Torino, Italy;
- University of Sheffield, UK.

These illustrate both diversity and convergence in industrial doctorate approaches.

To support consistency across institutions, contributors received a short research template outlining the elements to cover in their case study (See Annex C). Based on this common template, Table 1 summarises key characteristics of the six case studies to facilitate comparison.

University	Funding model	Employment & structure	Supervision & IP	Distinctive elements
Aalborg University (DK)	National Industrial PhD scheme combining company contribution (≥50% of total costs) with Innovation Fund Denmark grants.	Candidate employed by company (e.g. public- and private companies); work carried out in both environments with flexible time allocation (no fixed split).	Joint supervision by university and company; IP governed by national model agreements.	National framework provides clear rules on roles, funding responsibilities and supervision, enabling predictable collaboration.
Brno University of Technology (CZ)	Combination of scholarship, company salary, or both; minimum PhD income set by national legislation.	Candidate employed by company; industrial doctorate follows regular PhD standards, formalised through a three-party agreement.	IP and confidentiality arrangements negotiated between student and company; employment must comply with Czech Labour Code.	Growing national interest and new legislation; contractual clarity is essential for managing confidentiality and publication issues.
Budapest University of Technology & Economics (HU)	Three routes: individual company-funded doctorates; firm-funded stipend + bench fee; state-funded Cooperative PhD Programme (competitive national quota).	Student employed by company (usually part-time) while enrolled at university.	Firm often holds IP in company-led models; cooperative programme uses negotiated IP rules.	Long-standing engagement with companies; strong publication and patent outputs; cooperation structured through doctoral schools.

University	Funding model	Employment & structure	Supervision & IP	Distinctive elements
Gdańsk University of Technology (PL)	Ministerial scholarship (42–64% of professor salary) plus company salary; Ministry also funds research infrastructure.	In the Industrial Doctoral School (SDW), candidate is a full-time company employee; in the Doctoral School, candidate is scholarship-funded.	Highly structured IP regime: company acquires project outcomes; dissertation copyright retained by candidate.	Part of Poland's Implementation Doctorate programme (Program Doktorat Wdrożeniowy) with formalised tripartite cooperation and strong support structures.
Politecnico di Torino (IT)	Predominantly company-funded or co-funded scholarships; apprenticeship doctorates; and doctorates supported by Italy's National Recovery and Resilience Plan (PNRR – Piano Nazionale di Ripresa e Resilienza).	Mixed models: university-based with company stays; apprenticeship doctorates involve company employment.	IP defined in university–company agreements; administrative load significant under PNRR schemes.	High volume of collaborations; DM 226/2021 (Ministerial Decree) defines industrial doctorates, though rarely used due to restrictive criteria.
University of Sheffield (UK)	Company-funded PhDs; Industrial Doctoral Training Centres; KTP (Knowledge Transfer Partnership) projects; CASE studentships (Collaborative Awards in Science and Engineering) co-funded by industry and Research Councils.	Mostly university-employed, with periods in company; KTP associates employed via university but work primarily in company.	Academic supervision supported by industrial mentors; IP arrangements depend on the specific scheme.	Industrial PhD routes are widespread due to limited standard PhD funding; well-established national schemes support structured collaboration.

Table 1. Comparative overview of the six industrial doctorate case studies

3.1 Aalborg University

Aalborg University operates within a well-established national framework governed by the Danish Innovation Fund. Industrial PhD projects are typically three years and implemented jointly by a company or public-sector organisation, an industrial PhD candidate and a university, with the candidate employed by the company and enrolled at the university. Funding consists of a company grant (covering a substantial share of salary and mobility costs) and a university grant supporting supervision, training and infrastructure, with companies required to finance at least half of the total project cost. Time allocation between company and university is flexible, with no prescribed 50/50 split. Joint supervision and national model agreements support alignment of industrial relevance with academic standards, and salary conditions must be at least equivalent to those of university-employed PhDs. Additional details can be found in the relevant presentation.

3.2 Brno University of Technology

Brno University of Technology illustrates how industrial doctorates are being embedded in national strategies to raise added value and strengthen research and innovation capacity. Industrial PhD studies follow the same academic standards and duration as regular PhDs and are formalised through a three-party agreement between the university, the candidate and a company. Candidates are typically employed

by the company, with income arrangements governed by the Labour Code and recent legislation defining a minimum doctoral income. Benefits include closer alignment of research topics with industrial needs and improved access to industrial infrastructure, while challenges concern confidentiality, IP management and the implications of rising scholarship costs. Additional details can be found in the relevant presentation.

3.3 Budapest University of Technology and Economics

Budapest University of Technology and Economics (BME) operates several complementary industrial PhD models, including individual agreements with recognised R&D-active firms, firm-funded PhD stipendia and bench fees for joint projects, and a national cooperative PhD programme. In the first model, research is mainly carried out and supervised within the firm, with a BME consultant and doctoral school oversight; firms typically own any IP generated. In the cooperative PhD scheme, the candidate is simultaneously a university student and an employee of the cooperative partner, supported by a state stipend and an additional "cooperative stipend", with structured reporting and monitoring. These models have enabled a significant number of supported projects, high publication output, some patents, and strong engagement from both multinational and domestic companies, while preserving regular academic standards for awarding the PhD. Additional details can be found in the relevant presentation.

3.4 Gdańsk University of Technology

Gdańsk University of Technology has a multi-track structure for industrial doctorates, comprising the general Doctoral School, the Industrial Doctoral School (SDW), and external doctoral studies. The Industrial Doctoral School operates under Poland's national Implementation Doctorate programme (Program Doktorat Wdrożeniowy), which embeds doctoral research in socio-economic environments through employer collaboration. Candidates in SDW are full-time employees of companies or other entities and receive a ministerial scholarship in addition to their salary; the ministry also funds research infrastructure and training. Co-supervision is mandatory, and IP is governed by detailed agreements whereby companies acquire rights to project outputs, while doctoral candidates retain copyright over dissertations and publications, with shared-ownership models applied where relevant. Additional details can be found in the relevant presentation.

3.5 Politecnico di Torino

Politecnico di Torino offers a wide range of doctoral pathways involving industry. The legally defined industrial doctorate under DM 226/2021 is used infrequently due to restrictive requirements and limited suitability for SMEs. More commonly, companies co-fund scholarships within standard doctoral programmes, covering between one-third and full funding. Additional models include executive doctorates and apprenticeship doctorates for employees, as well as innovative doctorates co-funded under Italy's National Recovery and Resilience Plan (PNRR – Piano Nazionale di Ripresa e Resilienza). These schemes require a minimum period at the university, structured co-supervision and explicit IP agreements. Innovative doctorates have substantially increased the number of industry-linked PhD candidates, but challenges include heavy reporting requirements, administrative complexity and fragmented national vision on career progression. Additional details can be found in the relevant presentation.

3.6 University of Sheffield

The University of Sheffield case study reflects a diversified UK landscape for industrial doctorates, combining firm-specific sponsorships with national government schemes. Companies may fully fund a three-year PhD by covering fees and stipend, usually with candidates based primarily at the university and spending defined periods in the company, or they may support part-time employee PhDs where staff undertake doctoral studies alongside employment. National instruments include Industrial Doctoral Training Centres, Knowledge Transfer Partnerships (KTPs) where associates work on industrial challenges and may register for a PhD, and CASE studentships (Collaborative Awards in Science and Engineering) in which companies and Research Councils jointly fund doctoral projects. These arrangements attract both large firms and SMEs, giving companies access to university expertise and high-quality graduates at relatively modest cost, while academic supervision remains with the university and industrial mentors guide the practical aspects. Additional details can be found in the relevant presentation.

3.7 Summary

Across diverse national systems and institutional models, these case studies confirmed that industrial doctorates can:

- strengthen collaboration and trust between universities and companies;
- contribute to the development of skills useful to enhance the employability of doctoral candidates;
- improve the relevance, impact and visibility of research in key sectors;
- maintain academic standards comparable to traditional PhD programmes, provided that supervision and assessment are robust.

Taken together, these case studies complement those examined previously by Task Force Innovation, which involved:

- Ghent University, Belgium;
- NTNU, Norway;
- Universitat Politècnica de Catalunya, Spain;
- the University of Strathclyde, UK;
- the University of Stuttgart, Germany;
- Warsaw University of Technology, Poland.

Across the broad sample of the 12 case studies, involving 10 different countries, common patterns emerge in funding models, sectoral engagement, supervision, IP, publication practices and perceived benefits and challenges (see Annex A for the overview table of all 12 case studies).

4. Insights from the workshop in Trondheim

The Trondheim workshop on 22 May 2025 provided a rich, multi-perspective view on industrial doctorates, bringing together universities, industry representatives, policymakers and other stakeholders to discuss the role of industrial doctorates in strengthening research–innovation linkages, developing advanced skills and supporting Europe's competitiveness.

4.1 Panel I – Local ecosystem perspectives

The first panel explored how industrial doctorates can drive regional innovation by deepening collaboration between universities and businesses, including SMEs. The full list of panel participants and keynote speakers is provided in Annex B. Participants emphasised that:

- PhDs contribute not only technical expertise but also act as translators of academic knowledge into industrial innovation;
- Industrial doctorates are most effective when embedded in long-term collaborative structures such as centres of excellence or research-based innovation centres;
- SMEs often face specific entry barriers (limited resources, lack of experience with doctoral training, uncertainty about IP and supervision responsibilities) and need tailored guidance, simplified procedures and pooled funding mechanisms;
- Clear governance, expectations and co-supervision arrangements are crucial to prevent doctoral candidates from being treated as short-term consultants or routine staff.

4.2 Keynote – European perspective and MSCA

In an invited keynote from the European Commission's MSCA unit, industrial doctorates were framed as a key instrument for Europe's competitiveness and for closing the gap between research and innovation. The intervention highlighted that:

- Industrial doctorates embed "valorisation by design" by integrating research, skills development and collaboration with industry directly into doctoral training;
- MSCA doctoral networks already support a significant number of industrial doctorate consortia, including many with SME participation. Under Horizon 2020, 155 MSCA industrial doctorate projects were funded, supporting around 930 PhD candidates, about 40% of whom were hosted by SMEs. These projects represent roughly 6% of all MSCA doctoral network proposals funded, indicating that their overall share remains modest;
- Challenges highlighted in the keynote and workshop discussions include the complexity of joint supervision, administrative burden and programme rules that may limit flexibility.

These messages echo our MSCA position, which called for: a substantial boost in the MSCA budget as part of at least doubling the overall EU framework programme; using MSCA as a trendsetter for research careers; improving conditions for intersectoral mobility; and preserving the bottom-up excellence model while enabling stronger structuring effects and career support.

4.3 Panel II – frameworks, skills and competitiveness

The second panel examined systemic issues crucial for scaling industrial doctorates across Europe:

- Fragmented definitions and regulations for industrial doctorates across member states complicate joint programmes, recognition and portability for doctoral candidates;
- Alliances such as Unite! have responded by creating common governance models, codes of conduct and regulatory framework agreements for joint doctoral programmes with non-academic partners.
- Survey evidence from the EUA Council for Doctoral Education shows broad uptake of collaborative doctorates with non-academic partners, but also limited employer recognition of the PhD as a qualification, particularly outside academia;
- Experiences from entrepreneurial doctoral schools and innovation-oriented programmes show that high value can be created, yet sustainable financing models and realistic return-on-investment timelines are needed to make such schemes viable for industrial partners.

Participants also reflected on whether new, flexible training models beyond traditional multi-year PhDs may be needed to recognise advanced research and innovation skills for professionals who cannot commit to a full doctorate, in addition to strengthening existing industrial doctorate pathways. While the advantages of the shortened training for the participants and for the future employers are obvious, the level and depth of knowledge acquired may vary depending on the structure and duration of the programme.

4.4 Cross-cutting conclusions from the workshop

Taken together, key messages from the case studies, keynote and panels include the need to:

- enable flexible doctoral pathways combining academic and industrial doctorates within single networks or programmes;
- simplify funding and administration at national and EU levels, particularly to lower barriers for SMEs;
- invest in robust co-supervision models, transferable skills training and support structures for doctoral candidates;
- explore complementary qualifications and pathways that bridge academia and industry;
- invest in and further develop MSCA, including its industrial doctorate dimension, with increased visibility, flexibility and incentive structures.

5. Key cross-cutting findings from the workstream

The combined evidence from case studies, the Trondheim workshop and earlier Task Force Innovation work suggests several cross-cutting findings.

5.1 Diverse models, shared objectives

Across Europe, industrial doctorates take many forms—formal national schemes, university-specific arrangements, sector-based centres, and European-level networks (including MSCA industrial doctorates). Despite this diversity, their objectives converge:

- giving doctoral candidates meaningful experience in non-academic settings while maintaining high academic standards;
- strengthening research–innovation linkages and accelerating knowledge transfer;
- supporting regional and European competitiveness and strategic autonomy;
- enhancing employability, career prospects and transferable skills for PhD graduates.

5.2 Administrative complexity as a structural barrier

Most successful schemes feature mixed funding models that combine public resources – including university contributions - with industry contributions. However, complexity in funding rules, reporting, salary regulations and IP arrangements remains a major barrier, particularly for SMEs and cross-border collaborations. Heavy administrative burden is also reported for some MSCA industrial doctorates and national schemes, confirming the need for simplification and flexibility in line with our MSCA position.

5.3 Parity of academic quality and the central role of supervision

High-quality co-supervision is indispensable for ensuring that industrial doctorates remain equivalent in quality to "traditional" PhDs. This requires a clear understanding of how academic and industrial supervisors contribute - for example, the academic supervisor ensures scientific rigour, methodological soundness and progression within the doctoral framework, while the industrial supervisor provides applied relevance, access to real-world environments and guidance on practical implementation. Both share responsibility for supporting the candidate and steering the project.

Good practice includes: co-designed research plans, clear expectations on time spent in academic and industrial environments, and explicit agreements on assessment and publication.

5.4 Intellectual property, openness and dissemination

IP arrangements vary widely, from university-owned IP with licensing options, through company-owned IP, to shared ownership. Ambiguity or late negotiation of IP and confidentiality can create conflicts and delay publication of results. Best practices involve transparent, pre-agreed IP clauses and publication procedures, aligning with CESAER's broader work on balancing open science with the protection of sensitive knowledge. Aligning national and institutional approaches with EU-level expectations, including those in MSCA and other Horizon Europe instruments, is essential to avoid fragmentation.

5.5 Career development and recognition of doctoral graduates

While industrial doctorates are widely recognised within universities as valuable, employer recognition of PhDs—especially beyond academia—remains uneven. Survey evidence and case studies highlight the need to strengthen employer awareness of the value of doctoral competences, improve career guidance for doctoral candidates, and ensure that industrial doctorates are integrated into broader research career frameworks. This aligns with our MSCA position which frames the actions as a key instrument for advancing research careers and calls for dedicated efforts to make them a trendsetter for high-quality research jobs.

6. Implications for MSCA and other EU instruments

MSCA are uniquely positioned to support and scale industrial doctorates across Europe, consistent with the priorities set out in our position 'Unleash full potential of Marie Skłodowska-Curie Actions'. Key implications of our study include:

- **Boosting support for industrial doctorates within MSCA**: MSCA industrial doctorates currently represent only a small proportion of all MSCA doctoral projects. In line with our call to at least double the next EU framework programme budget and substantially boost MSCA, we encourage reinforced and more visible support for industrial doctorate consortia, including those involving SMEs and diverse non-academic partners.
- **Enhancing flexibility and simplification**: Feedback from the field confirms the need for frameworks that better reflect the operational reality of joint academic–industrial supervision and co-investment. Mixed consortia should be able to combine academic and industrial doctorates within a single network without facing disproportionate administrative constraints. Simplification and proportionate, risk-based reporting would reduce unnecessary burden while maintaining clear expectations on excellence, training quality and impact. Greater room for institutional autonomy, combined with transparent monitoring and ex post evaluation, would strengthen partnership models without weakening accountability.
- **Strengthening the MSCA role in advancing research careers**: The role of industrial doctorates should be further strengthened also in the communication around MSCA, reinforcing its role as flagship instrument for high quality research careers both within academia and in non-academic sectors, including industry.
- **Ensuring complementarity with national and regional schemes**: MSCA industrial doctorates should be designed to complement national and regional programmes. This includes promoting mutual learning, portability and compatibility of doctoral training frameworks and quality standards across Europe.

7. Recommendations

In light of the evidence gathered through case studies, and the Trondheim panel discussions, four strategic priorities stand out:

- **Scale high-quality industrial doctorates through reinforced European and national funding**, in particular by strengthening the Marie Skłodowska-Curie Actions (MSCA) within a significantly reinforced next EU framework programme.
- **Simplify and align regulatory and administrative frameworks**, especially to lower entry barriers for SMEs and cross-border cooperation.
- **Embed industrial doctorates within coherent doctoral governance and research career frameworks**, ensuring parity of academic standards while strengthening intersectoral mobility and talent pipelines.
- **Ensure clear and balanced intellectual property frameworks**, including transparent IP arrangements and publication rules that balance open science principles with legitimate commercial interests in university–industry collaboration.

These priorities underpin the more detailed recommendations set out below.

7.1 To EU institutions

- In line with our call to at least double the budget of the next framework programme for research and innovation (FP10), equivalently and substantially boost the resources for MSCA. Within this reinforcement, greater visibility and strategic recognition should be given to industrial doctorates and other intersectoral doctoral models that demonstrably strengthen research–innovation linkages, intersectoral mobility and Europe's competitiveness. This requires MSCA calls, evaluation criteria and implementation rules that enable the scaling of high-quality academic–industrial consortia, including SME participation.
- Strengthen MSCA as a trendsetter for research careers by embedding industrial doctorates and intersectoral mobility as core elements and by enhancing their role in developing transferable skills and high-quality research jobs across sectors.
- Simplify and streamline the design and implementation of MSCA industrial doctorates, reducing administrative burden for universities and focusing on proportionate, risk-based accountability, especially for small and medium-sized institutions and SMEs.
- Promote mutual learning on industrial doctorates by supporting exchanges of practice, mapping initiatives, and joint guidelines, in cooperation with key stakeholder organisations such as CESAER, the EUA Council for Doctoral Education and others.
- Ensure that MSCA and other EU instruments support diverse forms of collaboration, including flexible models that combine academic and industrial doctorates within single networks, and that explore complementary qualifications for innovation-oriented professionals.

7.2 To member states and regional authorities

- Develop or refine national frameworks that recognise and support industrial doctorates as an integral part of the doctoral landscape, ensuring clear definitions, quality standards, and alignment with broader skills and innovation strategies.
- Provide stable, long-term funding instruments for industrial doctorates and other collaborative doctorates, including dedicated schemes to support SME participation.
- Reduce legal and administrative obstacles, especially those related to employment status, social security and minimum income for doctoral candidates, to enable coherent and attractive industrial doctorate offers that are compatible with academic requirements.

- Promote transparent and balanced IP frameworks and model agreements that protect academic freedom and scientific integrity while enabling effective knowledge transfer and commercialisation.
- Encourage national dialogue and coordination among universities, funding agencies, employers and social partners on the role of industrial doctorates in national skills and innovation policies.

7.3 To universities of science and technology and other research-performing organisations involved in doctoral training with industry partners

- Embed industrial doctorates in institutional strategies for research, innovation, education and engagement, rather than treating them as isolated or ad hoc arrangements. Ensure that candidates are fully integrated in academic communities and doctoral environments alongside other PhD candidates.
- Strengthen doctoral schools and support structures to provide high-quality co-supervision, skills training and career guidance for industrial doctorate candidates, ensuring parity of academic standards and assessment criteria with traditional PhDs.
- Develop or use existing model agreements for collaboration with companies and other non-academic partners, covering supervision, IP, publication, data management, research security and ethics, and ensure that doctoral candidates are fully informed and supported.
- Where appropriate, create cohort-based and centre-based models for industrial doctorates where possible, to provide a rich research environment, peer networks and sustainable collaboration with non-academic partners, building on insights from the Task Force Innovation report.
- Systematically monitor and evaluate industrial doctorate schemes, including candidate outcomes, employer satisfaction and impact on research and innovation, and use these insights to continuously improve programme design.

7.4 To industry, SMEs and other non-academic partners

- Engage proactively with universities of science and technology to co-create industrial doctorate projects and programmes that address strategic business and societal challenges.
- Provide meaningful research environments, supervisory capacity, and time allocation for doctoral candidates, recognising that an industrial doctorate is a research and training endeavour, not short-term consultancy.
- Offer competitive terms and clear career perspectives for industrial doctorate graduates, thereby improving employer recognition of the PhD and attracting high-potential talent.
- Work with universities to establish clear, fair and transparent IP and confidentiality arrangements that support both knowledge transfer and academic dissemination, including to balance commercial advantage with open science, as discussed in CESAER's event article on this topic (December 2020).
- Participate in regional and European networks, centres and alliances that share good practice and explore innovative models for combining research, innovation and skills development.

Industrial doctorates are more than a specific programme format: they are a strategic instrument to bridge research and innovation, to empower researchers, and to strengthen Europe's high-skilled workforce.

With enabling frameworks, sustainable funding and a culture of mutual trust, they can play a central role in delivering on Europe's ambitions for competitiveness, resilience and societal progress. CESAER and its Members stand ready to continue collaborating with EU institutions, member states, industry and other partners to shape the future of industrial doctorates in Europe.

Annex

Annex A. Overview of the twelve industrial doctorate case studies

This annex presents a comparative overview of the 12 industrial doctorate case studies, summarising key features such as funding models, candidate status, supervision arrangements, intellectual property approaches, and reported benefits and challenges.

Institution	Candidate status (employment/ enrolment)	Funding model	Supervision model	Intellectual property & confidentiality	Reported benefits and added value	Reported challenges
Aalborg University	Employed by company; enrolled at university	Company grant covering salary and mobility; Innovation Fund Denmark support; university grant for supervision, training and infrastructure; company covers at least half the cost; no fixed time-split required	Joint supervision; Danish national model agreements; salary conditions equivalent to university-employed PhDs	Intellectual property challenges when results have commercial value; importance of early agreements	Strong industrial relevance combined with academic standards; flexible arrangements; effective coordination	Administrative complexity; need for clear intellectual property arrangements; coordination requirements
Brno University of Technology	Typically employed by company; income governed by Czech Labour Code; minimum doctoral income defined in national legislation	Salary funded by company; scholarships or mixed arrangements depending on contract	Three-party agreement (university–candidate–company); same academic standards and duration as regular PhDs	Strong confidentiality focus; non-disclosure agreements standard; dissertation disclosure may be contested	Access to industrial infrastructure; alignment of topics with industrial needs; income security	Confidentiality and intellectual property disputes; complex contracting, especially with multinational firms; rising scholarship costs
Budapest University of Technology and Economics	Varies: firm-employed; cooperative doctoral candidates (employed + enrolled); university-enrolled with industrial support	Firm-funded stipends or bench fees; in the national Cooperative Doctoral Programme: state doctoral stipend plus additional cooperative stipend	Firm-based research with university oversight; structured reporting and monitoring in cooperative scheme	Companies typically own intellectual property in firm-based model; negotiation required if disputes arise	High number of projects; strong publication output; some patents; engagement from multinational and domestic companies	Reporting burdens; administrative complexity; intellectual property and confidentiality issues
Gdańsk University of Technology	Full-time employees of company; enrolled in Industrial Doctoral School; receive	Ministry scholarship; employer salary; national funding supports research	Mandatory co-supervision	Company acquires rights to project outputs; candidates retain copyright for	Embeds doctoral work in socio-economic environments; structured training; strong	Not specified beyond intellectual property arrangements

Institution	Candidate status (employment/ enrolment)	Funding model	Supervision model	Intellectual property & confidentiality	Reported benefits and added value	Reported challenges
	salary plus ministerial scholarship	infrastructure and training		dissertation and publications; shared ownership models possible	national support	
Politecnico di Torino	Multiple pathways: industrial doctorate (rare); standard PhD with company co-funding; employee doctorates; apprenticeship doctorates; "innovative doctorates" funded under Italy's National Recovery and Resilience Plan	Company co-funding (33%–100%); National Recovery and Resilience Plan funding; regional support for apprenticeship doctorates	Structured co-supervision; minimum period physically at university; formal agreements define roles	Explicit intellectual property agreements; varies by model	Strong growth in industry-linked doctorates; flexible models for collaboration	Heavy reporting obligations; administrative complexity; restrictive legal industrial doctorate model unsuitable for SMEs; fragmented national career framework
University of Sheffield	Primarily university-based PhDs with industry placements; also employee PhDs (staff study alongside employment)	Company-funded PhDs (covers fees and stipend); employer-supported part-time PhDs; national schemes including Industrial Doctoral Training Centres, Collaborative Awards in Science and Engineering, and Knowledge Transfer Partnerships	Academic supervision by university; industrial mentor for applied components; structured periods at the company	Contractual intellectual property and confidentiality terms; publication governed by agreements	Access to university expertise; high attractiveness to SMEs and large firms; strong applied relevance	Intellectual property timelines; balancing academic and industrial expectations
Ghent University	Company-employed candidates; enrol through a personal doctoral mandate	Company finances project; Flemish government (Flanders Innovation & Entrepreneurship) co-funds at least 50%	Accredited academic supervisor and industrial supervisor; academic and industrial panel for oral examinations	IP agreements required before defense; model contracts available	Strong academic–industrial collaboration; positive feedback from candidates and companies; real-world relevance	Intellectual property complexity; administrative burden; balancing basic and applied research
Norwegian University of Science	Employed by university, research	Mixed funding: NTNU basic funding; public	Embedded in large-scale academia–	Consortia-level intellectual property	Strong access to industry; clear career	Topic alignment across partners; publication

Institution	Candidate status (employment/ enrolment)	Funding model	Supervision model	Intellectual property & confidentiality	Reported benefits and added value	Reported challenges
and Technology	institute, public body, or company depending on centre project	and industry partners; Research Council of Norway; large-scale Centres for Research-based Innovation (SFI) and Centres for Environmentally Friendly Energy (FME) co-funded by Research Council, industry and university	industry centres; interdisciplinary research environments involving academic and industrial partners	agreements; publication may be delayed to protect confidential results	development; interdisciplinary environments	delays; need for follow-up funding
Universitat Politècnica de Catalunya	Company-based doctoral candidate; minimum gross annual salary (€22,000); enrolled at university	Two modalities: co-funding (for companies with COR Centre in Catalonia) and specific funding (open to international companies); compatible with grants and credits; multiple calls per year	Academic supervisor must belong to accredited research group or receive ERC funding; company must designate project overseer	Tension between confidentiality and open access; balancing academic and industrial interests	Large scale (900 projects; €120m); positive company feedback; theses comparable in quality and publications to conventional doctorates; strong R&D impact	Conflicting academic–industrial interests; confidentiality vs publication balance
University of Strathclyde	Industry-funded cohorts and university-based programmes sponsored by companies; engagement through industry research centres	Government support and direct industry sponsorship; joint proposals with firms	Academic supervisors and industry mentors; students split time between university and industry; strong senior sponsorship engagement	IP and publication guidelines defined in pre-approved research contracts; confidentiality agreements; publication timelines may require negotiation	Access to industry contacts; applied research; holistic skill development; strong career preparation; model replicated across fields	Translating industry projects into academic writing; IP and confidentiality issues; need for strong management and coordination
University of Stuttgart	University- and/or industry-employed depending on joint proposal	Public funding (EU, federal), industry partnerships and bilateral contracts; joint proposals between university and industry	Division of roles, supervision team, publication guidelines and compensation defined through memorandum of understanding	IP rights defined in cooperation contracts; ownership typically lies with employee or employing institution	Applied, industry-relevant research; strong industrial contacts; academic and technical support; R&D career outcomes	Coordination requirements; need for clear communication, defined roles and sustained support over programme duration

Institution	Candidate status (employment/ enrolment)	Funding model	Supervision model	Intellectual property & confidentiality	Reported benefits and added value	Reported challenges
Warsaw University of Technology	Employed by external private or public entity; admitted to university Doctoral School; receives ministry-funded scholarship alongside employment	National "Implementation Doctorate" scheme; Ministry of Science and Higher Education funding; strands include general track, artificial intelligence & quantum technologies, and metrology	Faculty-based recruitment; cooperation between doctoral school and employing entity; academic and workplace supervisors involved	IP arrangements not specified	Research embedded in workplace; structured integration of didactic practice with employment; strong socio-economic orientation	Employment continuity risks; supervisor turnover; overburdening of doctoral students; weak institutional cooperation patterns; financial risk to university; lack of systemic supervisor training; weak incentives for workplace supervisors

Annex B. Participants in the Trondheim workshop panels

This annex lists the moderators and panelists who participated in the two panel discussions during the workshop 'Industrial doctorates: shaping the future of Europe's high-skilled workforce', held on 22 May 2025 in Trondheim, Norway, kindly hosted by Norwegian University of Science and Technology (NTNU) .

Panel I – Local ecosystem perspectives

Moderator

Justyna Szostak, Co-Chair of the CESAER Task Force Learning & Teaching; Chair of the Internationalisation Committee and Rector's Representative for International Educational Programmes, Gdańsk University of Technology.

Panelists

Toril Hernes, Co-Chair of the CESAER Task Force Innovation and Pro-Rector for Innovation, Norwegian University of Science and Technology.

László Nyulászi, Chair of the Doctoral Council, Budapest University of Technology and Economics.

Eduardo Martínez (online), Project Manager, Aigües de Barcelona.

Marek Kruszewski, Director of International Relations and Innovative Projects, INWEBIT.

Kathrine Kjos Five, Industrial PhD candidate, Norwegian University of Science and Technology / Nutrimar.

Panel II – European perspective: frameworks, skills and competitiveness

Moderator

Roberto Zanino, Co-Chair of the CESAER Task Force Learning & Teaching and Rector's Senior Advisor for International University Networks and the European University Alliance Unite!, Politecnico di Torino.

Panelists

Simon Marti, Head of the EUA Council for Doctoral Education (EUA-CDE).

Sohail Luka, Policy Officer, Marie Skłodowska-Curie Actions, European Commission.

Alberto Gonzales, Innovation and Entrepreneurship Education Manager, EIT InnoEnergy.

Eugenio Brusa (online), Professor; former Head of the Doctoral School and Executive Committee member, UNITE European Alliance; UDS Board Coordinator, UNITE Doctoral School (2025–2028).

Annex C. Case study template used for industrial doctorate case studies

To support consistency across participating CESAER Member universities, contributors were invited to prepare case studies using the following template.

1. Research objectives

The case studies aimed to:

- explore key features, successes and challenges of institutional industrial doctorate programmes;
- identify barriers related to legislation, governance and funding at different levels (e.g. European Commission, member states, universities and industry);
- provide insights to inform discussions and policy recommendations for strengthening industrial doctorate programmes;
- highlight the contribution of industrial doctorate programmes to European competitiveness, skills development and collaboration between universities and industry.

2. Data collection

Contributors were invited to draw on multiple sources of information, including:

- interviews with at least one industrial partner involved in an industrial doctorate project or programme;
- interviews with institutional leaders responsible for doctoral education or industrial doctorate programmes;
- relevant institutional documents, reports, guidelines and other available sources.

3. Case study structure

Contributors were invited to structure their case studies around the following elements.

Background and context

- Provide an overview of the institution's industrial doctorate programme or model.
- Describe the objectives, governance and main partnerships with industry.
- Indicate the sectors or industries engaged with the programme.

Key characteristics

- Highlight distinctive features of the institutional approach to industrial doctorates.
- Describe how collaboration with industrial partners is organised and supported (e.g. joint supervision, co-designed research projects, intellectual property agreements).
- Explain the funding model, including government support, industry contributions or collaborative funding schemes.
- Outline key organisational aspects, such as publication rules and the allocation of time between academic and industrial environments.

4. Key findings and outcomes

Case studies were invited to reflect on:

- Outcomes and added value for universities, doctoral candidates and industry partners;
- Key features, successes and challenges of the institutional industrial doctorate model;
- Evidence of impacts on employability, skills development and university–industry collaboration;
- Barriers related to legislation, governance or funding.

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