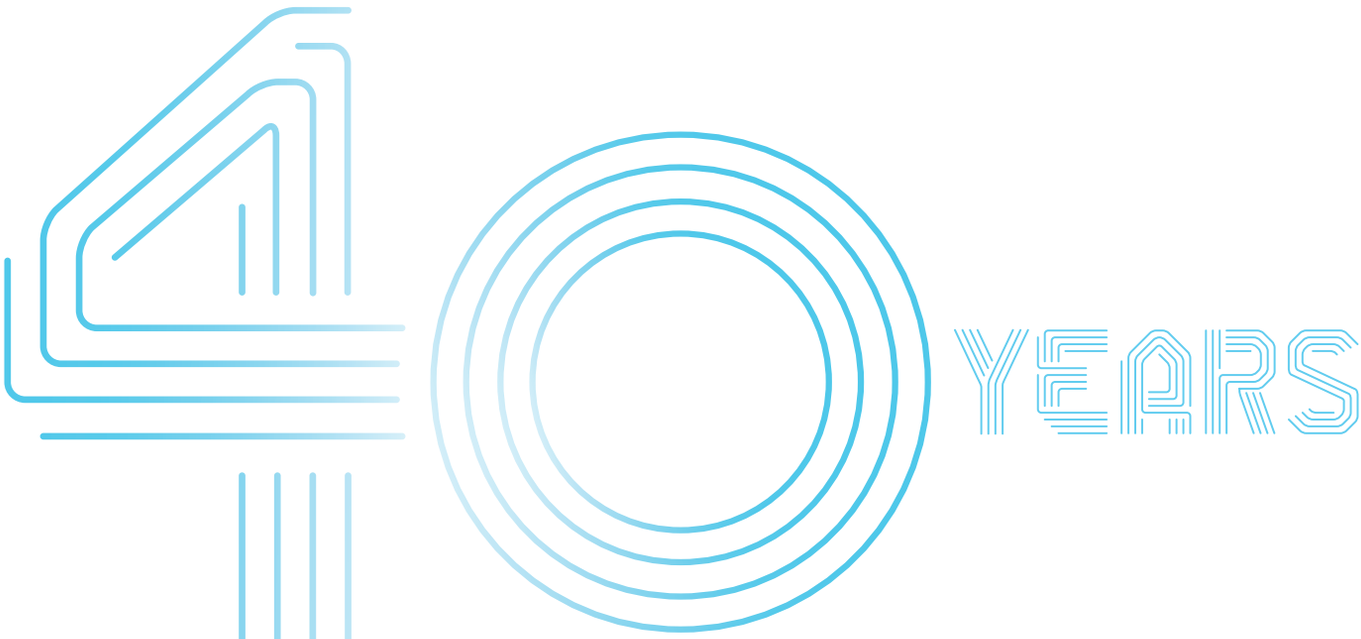
INESC TEC

10 YEARS

'25 ACTIVITY REPORT

INESC TEC



'25 ACTIVITY REPORT

Editorial Notes

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GLOBAL ACTIVITY REPORT 2025

Executive Summary

The year 2025 marked a defining moment for INESC TEC, as the institute celebrated four decades of activity. This milestone year unfolded in a world marked by geopolitical instability, accelerated technological transformation, and mounting environmental and societal pressures. In Europe, these dynamics reinforced priorities around strategic autonomy, technological sovereignty, industrial resilience, and the governance of emerging technologies, highlighting the importance of research and innovation as sources of capability, long-term direction, and public value.

Against this backdrop, INESC TEC combined institutional reflection and renewal with strong performance across science, innovation, talent, and societal engagement. The institute sustained growth in both activity and community, reinforced its scientific and technological capacity, and deepened its engagement with industry, public policy and international partners. This trajectory was supported by strong participation in major funding instruments, including the Portuguese Recovery and Resilience Plan (PRR), PT2030, and Horizon Europe, enabling the development of strategic initiatives and partnerships across multiple domains.

The year also stood out for its strong institutional performance and recognition. INESC TEC was awarded the highest classification of "Excellent" in the national FCT R&D Units Evaluation, confirming its capacity to combine scientific excellence with economic and societal impact. Total activity reached €39.7M, an 18% increase compared to 2024, extending a sustained trajectory of growth. This performance reflects both the robustness of the institute's funding model and its ability to adapt to national and European dynamics.

The 40th anniversary became a defining element of the year, strengthening institutional identity, internal cohesion, and external visibility. More than a commemorative programme, it created a structured opportunity to connect legacy, present performance, and future ambition. Flagship events such as the 10th edition of the INESC TEC Autumn Forum, dedicated to the societal implications of artificial intelligence, brought together a record number of participants and fostered dialogue on the intersection between technology, ethics, and society. Complementary initiatives further reinforced engagement with students, partners, and the broader community, consolidating a shared sense of purpose across the organisation.

Scientific excellence remained at the core of INESC TEC's activity. In 2025, the institute maintained a high level of scientific output, with 932 indexed publications, while reinforcing quality and visibility through sustained presence in top-tier journals and conferences. This trajectory was further marked by the elevation of Ricardo Bessa to IEEE Fellow, one of the highest international distinctions in engineering. Continued investment in talent and advanced training strengthened the research ecosystem, including the expansion of doctoral education and targeted recruitment in key scientific areas, supported in part by the FCT-Tenure Programme. INESC TEC also reinforced its leadership in Open Science and research data management, contributing to national initiatives and promoting the adoption of FAIR principles.

Technology transfer and innovation activities also advanced significantly. In 2025, INESC TEC ranked among the top three Portuguese organisations in the European Patent Office (EPO) index, supported by record patenting activity, including 19 new priority patent applications and a total of 56 active patent families. The establishment of the Entrepreneurship and Spin-offs Office further strengthened institutional capacity to support venture creation and deep-tech entrepreneurship. This trajectory was illustrated by the launch of the new spin-off KEPsoft, developed with European partners to address high-impact healthcare challenges, and by its distinction at the EARTO Innovation Awards, marking the third consecutive year in which INESC TEC reached the podium of these European awards.

Collaboration with industry and the public sector remained a central pillar of activity. INESC TEC expanded its R&D collaboration base through participation in large-scale initiatives, particularly under the PRR, while reinforcing its capacity to deliver and demonstrate advanced industrial technologies in real-world environments. The launch of TEC4COMMUNICATIONS marked an important step in structuring innovation ecosystems in advanced communications, fostering closer alignment between research, industry needs, and emerging opportunities. In parallel, the institute strengthened its portfolio of direct services and contributions to industry-oriented technology and sectoral roadmaps, supporting transformation and competitiveness across areas such as energy, manufacturing, health, and telecommunications.

INESC TEC also reinforced its role in building and integrating research and innovation ecosystems. The launch of the INESCTEC.OCEAN Centre of Excellence in Ocean Research and Engineering marked a major step in fostering multidisciplinary collaboration aligned with European priorities. At the same time, the institute strengthened its strategic positioning in domains such as semiconductors, artificial intelligence, high-performance computing, and energy systems, notably through its involvement in the new Portuguese Competence Centre in Semiconductors and through participation in international research networks.

Engagement in science and innovation policy continued to expand. The restructuring of the Foresight and Public Policy Office strengthened capabilities for foresight, strategic positioning, and policy engagement. In articulation with INESC Brussels HUB, these efforts enabled a coordinated and proactive contribution to key European and national policy processes, including discussions on the future Framework Programme (FP10), data governance, artificial intelligence regulation, and research infrastructures. The publication of position papers and strategic inputs, combined with the participation in high-level forums, working groups, and stakeholder consultations, reinforced the institute's role as a recognised provider of evidence-based contributions and an influential participant in shaping research and innovation agendas.

Internationalisation remained a strategic priority. INESC TEC expanded its global engagement through mobility programmes, strategic partnerships, and participation in international networks. The International Visiting Researcher Programme continued to attract a growing number of applications from leading institutions worldwide, reinforcing the institute's global attractiveness. Participation in exchange schemes, including Erasmus+, Fulbright, and other international mobility instruments, promoted both inbound and outbound mobility and strengthened international collaboration. At the same time, INESC TEC deepened cooperation with leading institutions and research infrastructures across Europe, Asia, and the Americas, supporting joint research, advanced training, and collaborative projects addressing global challenges.

Dissemination, outreach, and science communication also remained strong. INESC TEC hosted and co-organised major international conferences, including ECML-PKDD 2025, one of Europe's leading events in machine learning, which brought more than 1,300 participants to Porto, alongside other high-profile conferences in areas such as photonics, operations, and distributed systems. Participation in major international fairs and exhibitions, including Transport Logistic and ENLIT, further expanded the institute's visibility among industry and innovation stakeholders. These efforts were complemented by the consolidation of dissemination channels, a strengthened international media presence, and a diverse portfolio of advanced training initiatives, international summer schools, and specialised programmes in areas such as artificial intelligence, 6G communications, energy systems, and sustainability.

Human resources continued to grow and diversify, reflecting INESC TEC's increasing attractiveness. The total number of Core Human Resources reached 1,199 person-years, representing a 10% increase compared to 2024. This evolution was marked not only by growth, but also by the reinforcement of highly qualified personnel and a gradual increase in more stable and permanent positions. The launch and consolidation of the Research Student Office further strengthened structured support for students and contributed to more robust talent pipelines and the long-term sustainability of the institute's research capacity. In parallel, ongoing efforts to develop career frameworks, promote diversity and inclusion, and enhance organisational culture contributed to a more supportive and sustainable research environment.

Operational capacity remained a key performance enabler. Continuous efforts to improve organisational efficiency, streamline processes, and reinforce sustainable practices supported the institute's growth and resilience. Progress was also made in internal frameworks for ethics and compliance, contributing to a more robust and responsible research environment. Continued investment in research infrastructures, including the advancement of the Leixões Blue Hub and the development of SUSTEMARE, reinforced INESC TEC's capacity to support advanced experimentation and innovation in strategic domains. These efforts were complemented by further upgrades and investments, including those supported by the approved EQUIPAR+2 application, enhancing technical capabilities and experimental capacity.

Overall, 2025 confirmed INESC TEC's ability to respond to a rapidly changing environment with consistency, ambition, and institutional maturity. The progress achieved reflects strong alignment with the Strategic Plan 2023–2030, with visible results across its core commitments in science, innovation, talent, and societal engagement. As it builds on four decades of activity, INESC TEC remains committed to advancing scientific excellence, fostering a dynamic and inclusive community, and contributing to the development of more sustainable, resilient, and technologically advanced societies.

1 INTRODUCTION

This document presents the scientific and technological activities, as well as the main results of INESC TEC during 2025.

Section 2 offers a summarised presentation of the institute's profile, vision, mission, organisational model, research and innovation goals and strategic commitments.

Sections 3 and 4 present the highlights and main activity indicators for 2025, namely in human resources, project activity, scientific publications, intellectual property and dissemination.

The high-level research and innovation outcomes are further developed for the Scientific Domains, Thematic Lines and TEC4 initiatives in Sections 5, 6 and 7, which translate strategic orientations into domain- and theme-specific results.

Section 8 details the scientific and technological outcomes by the thirteen Research Centres, including their research and innovation highlights.

Special projects are addressed in Section 9, namely the UT Austin Portugal Program and INESC TEC.OCEAN, the Centre of Excellence in Ocean Research and Engineering.

The reports on the activities of the Offices, Commissions and ESG, as well as the Support Services, all of which play key roles in enabling many of the highlights of 2025, are presented in Sections 10 and 11.

Section 12 describes the institute's main research infrastructures, which support both research and technology transfer activities, as well as INESC TEC's participation in several national research infrastructures and Section 13 presents more detailed information on the main indicators of the Centres activities carried out in 2025.

2 INESC TEC PRESENTATION

2.1 Purpose, Vision, Mission and Values

INESC TEC is a private, non-profit association with Public Interest status, dedicated to scientific research and technological development, technology transfer, advanced consulting and training, and pre-incubation of new technology-based companies.

The University of Porto, INESC, the Polytechnic Institute of Porto, the University of Minho and the University of Trás-os-Montes e Alto Douro are INESC TEC's associates. INESC TEC's sites are located in Porto, Braga and Vila Real. At the end of 2025, INESC TEC hosted a research team of more than 580 researchers, including 410 PhD holders, complemented by over 400 PhD students, and supported by a dedicated team of management, administrative and technical staff.

INESC TEC's purpose is to create a fulfilling and sustainable future through impactful science, technology, and innovation.

Its history and purpose are deeply intertwined with those of its academic associates. As set out in the bylaws, its purpose is to carry out excellent research and then to enhance their involvement and intervention in the development of the economic and social fabric, thus contributing to improve the performance and competitiveness of companies and institutions.

INESC TEC aims to be an inspiring and empowering force, driving the science and technology of digitally-enabled systems into overcoming society's challenges.

Pursuing this vision, the institution aspires to continually innovate across all the mission areas of academia, emphasising research and innovation but also contributing distinctively to education and furthering a flourishing collaborative environment, bridging it to the economy and society. The institute endeavours to be an international reference in its fields of activity, underpinned by the excellence of its research and innovation.

As a free-thinking and diverse community, INESC TEC's mission is to take on bold science, technology, and innovation challenges, empowering talent, collaborative ecosystems, and public policies that make a difference in our economy and society.

INESC TEC is a people-centred organisation that cultivates an inspiring discovery and learning environment where a diverse, critical- and free-thinking, venturesome, and creative talent community thrives. It values excellence and openness in science and technology. As such, the institute seeks purpose and meaning in its research as it bridges its scientific domains to societal challenges and problems. It collaborates with academia and other stakeholders to develop talent and build science, technology, and innovation awareness and capability, transforming its ecosystems at all levels and supporting policy- and decision-makers in implementing and formulating public policies.

The **merit of INESC TEC in accomplishing its mission** has been formally acknowledged by the Foundation for Science and Technology, with the institute's recognition as an **Associate Laboratory**, and by the Portuguese Ministry of Economy, with its recognition as a **Technology and Innovation Centre (CTI).**

INESC TEC's **six guiding principles adopted as the shared core values** of its community are: 1) **Rigour and excellence** – Thoroughly embed rigour in all work, from ideation through realisation to evaluation; 2) **Freedom to create and think** - Autonomy in pursuing intellectual agendas, free of unreasonable interference; 3) **Integrity** – Remain true to the institution's principles and act with transparency and compliance with ethical standards; 4) **Collaboration** – Share, with each other and with partners, all successes and challenges, as a cohesive community; 5) **Creativity** - Explore new areas to advance science and innovation, with bold curiosity and accepting the risk of failing as intrinsic to creating new things; and 6) **People-centredness** - Place people at the centre of all activities, as a community in which everyone is welcome and fully supported in their development.

2.2 High-level View of Science and Innovation

2.2.1 Knowledge Value Chain

INESC TEC's management and operational model implements the concept of end-to-end knowledge value chain, driving knowledge from its generation in research activities to its valorisation through different technology transfer instruments (Figure 2.1).

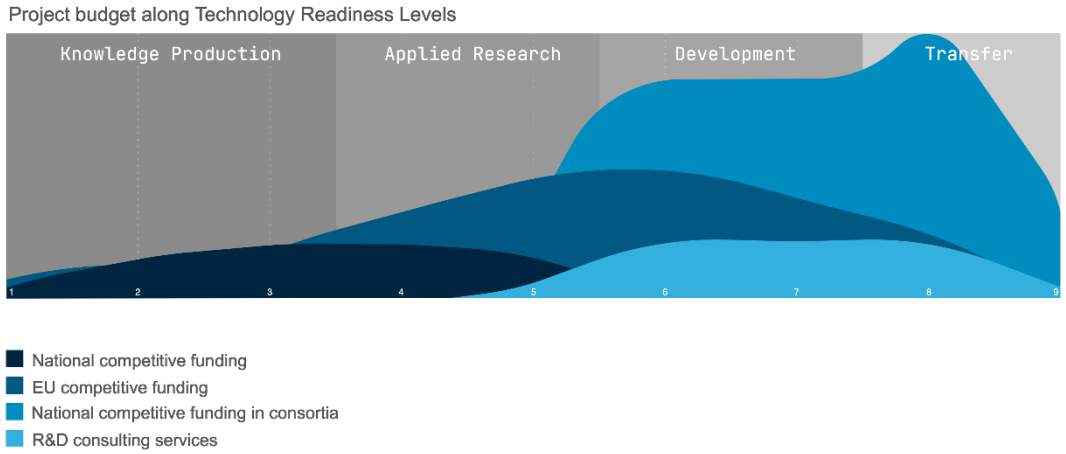


Figure 2.1 - End-to-end knowledge value chain: an integrated two-way pipeline

The concept is illustrated in a simplified manner in the figure above, which presents the knowledge value chain as a seamless integration of four stages – knowledge production, applied research, development, and technology transfer. Activities and outcomes of projects active in 2025 fall in different ranges of Technology Readiness Levels (TRLs) and are linked to different funding typologies. As with any model depicting a complex reality, the transitions between stages are fluid.

2.2.2 Centres, Scientific Domains and TEC4s

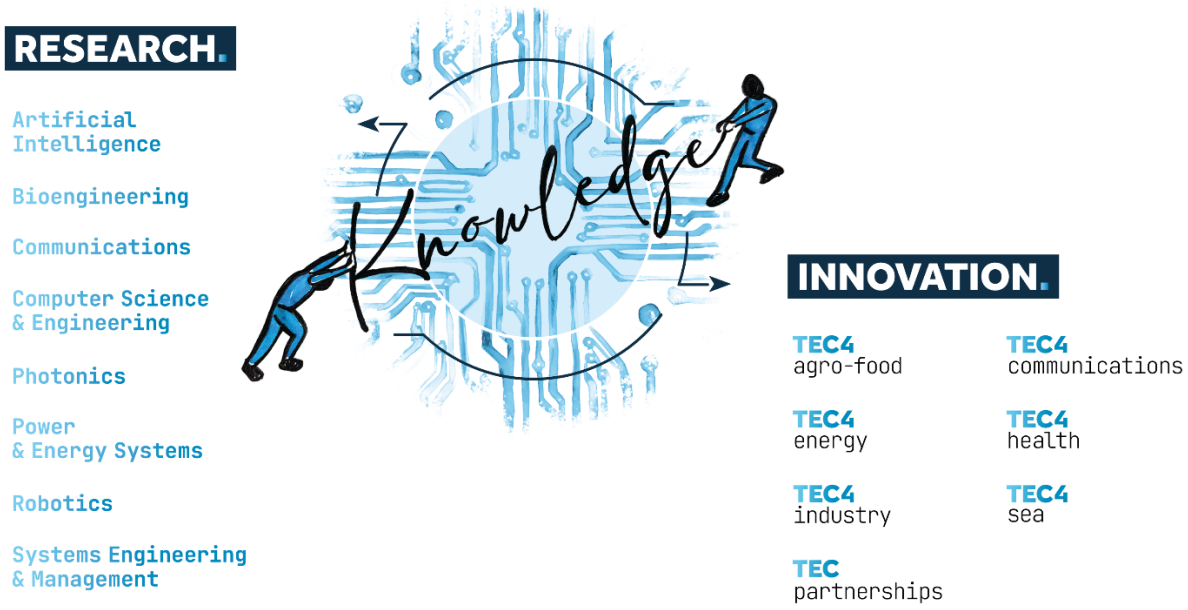


Figure 2.2 - High-level view of science and innovation at INESC TEC

Research and innovation at INESC TEC were conducted across its 13 Research Centres in 2025. As of January 2026, following the merger of two Centres, INESC TEC now comprises 12 Research Centres.

Research is structured in eight broad Scientific Domains: Artificial Intelligence, Bioengineering, Communications, Computer Science and Engineering, Photonics, Power and Energy Systems, Robotics, and Systems Engineering and Management. Innovation is focused on main technology market drivers expressed internally through the TEC4 initiatives - TEC4AGRO-FOOD, TEC4COMMUNICATIONS, TEC4ENERGY, TEC4HEALTH, TEC4INDUSTRY, and TEC4SEA in 2025 - and, since January 2026, also TEC4ASD.

The Research Centres are INESC TEC's R&D base organisational units, each focused on specific scientific and technological areas and responsible for its own planning, strategy and resources, reporting directly to the Board of Directors regarding budget and performance indicators.

The Scientific Domains structure the institute's research competences and challenges promoting strategic thinking, trajectory monitoring, and science communication.

The TEC4 initiatives articulate INESC TEC's activity towards the main market sectors and address current societal challenges, defining market strategies and planning the interaction with major application areas. A TEC4 initiative establishes a network of external contacts and a dialogue with industrial and institutional partners and brings back major challenges and opportunities to multiple Centres.

2.3 Organisational Structure

The institution's organisational structure (Figure 2.3) comprehends a Board of Directors composed of seven members and an Executive Board comprising four of those seven members, responsible for the high-level management of INESC TEC. The Boards act in close coordination with the Council of R&D Centres, meeting with the Centre Coordinators and the Managers of the different Support Services every other week. This ensures institution-wide coherence in vision, policy and operations, and joint responsibility and commitment in strategic and operational management decisions.

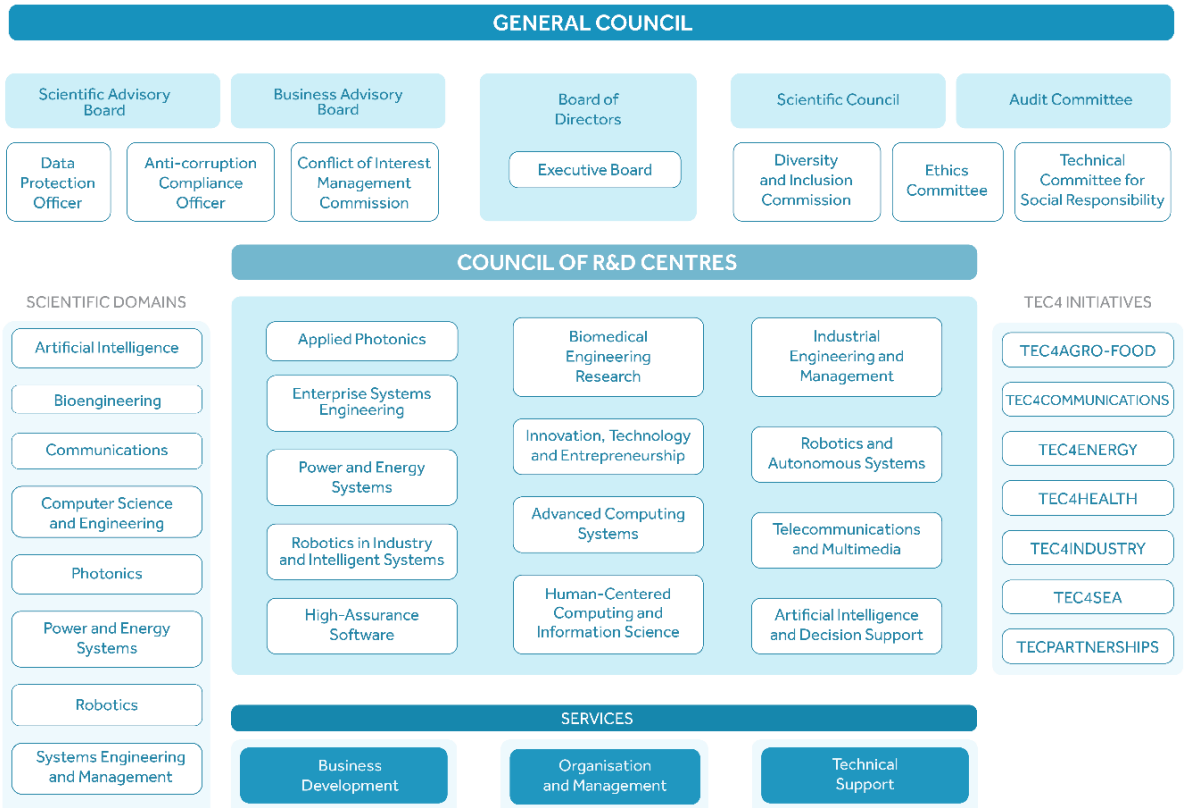


Figure 2.3 - Organisational Structure

The Scientific Advisory Board comprises currently twelve external internationally recognised scientists who support the institution's search for continuous improvement and excellence, building a vision for future research through a valuable benchmark at the international level. The external monitoring, orientation and evaluation of the technology transfer and innovation activities are entrusted to the Business Advisory Board, whose members have knowledge and experience in several economic sectors relevant to INESC TEC. The Scientific Council is an internal body responsible for monitoring and guiding scientific and technical activities, consisting of PhD researchers who participate permanently in INESC TEC's activities and includes one representative from each Centre and three additional members appointed by the Board of Directors.

The Audit Committee includes a Certified Public Accountant and oversees and validates the legal and financial behaviour of the Institute.

Six non-statutory bodies oversee aspects that INESC TEC particularly values. The Ethics Committee ensures the observance and promotion of integrity, honesty, and responsibility standards in research activities carried out by INESC TEC's members by implementing the institution's Code of Ethics. The Conflicts of Interest Management Commission (CGCI) and the Data Protection Officer are responsible for implementing the institute's Policy on Conflicts of Interest Management and the General Data Protection Regulation, respectively. The Anti-Corruption Compliance Officer is responsible for implementing the Compliance Programme for the prevention of corruption in articulation with other relevant organisational units. The Technical Committee for Social Responsibility has as its mission the incorporation of social responsibility in the institution's organisational culture and practices. The Diversity and Inclusion Commission encourages the organisation to implement practices that promote diversity and inclusion and develops long-term work in this field by proposing and implementing a D&I Program for INESC TEC, including gender balance as a major priority.

INESC TEC's activities are supported by a streamlined and dynamic team of highly qualified technical and administrative personnel, organised across key areas such as Business Development, Organisation and Management, and Technical Support Services, alongside specialised Offices focused on foresight and public policy, entrepreneurship and spin-offs, project management and research student support.

2.4 Areas of Intervention and Responsibility of the Board of Directors

To effectively fulfil its responsibilities and address the challenges inherent in the management of the institution, the Board of Directors of INESC TEC defined the distribution of areas of intervention and responsibility among its members for the 2024–2026 term.

This allocation takes into account the need to balance effort, valorise the individual profiles of each Member of the Board, ensure articulation between related areas, and promote proximity to the functions of the Executive Board. The distribution encompasses the operational areas entrusted to each Board Member, the leadership of missions aimed at institutional change in strategic areas, and the responsibilities for closer supervision of Support Services and liaison with R&D Centres, Scientific Domains, and TEC4 initiatives.

João Claro, Chairman and Chief Executive Officer – Coordination of Strategic Management; Planning and Reporting; Coordination of Operational Management; Strategic Partnerships – Public Sector; General Council; Audit Committee; Foresight and Public Policy Office; Entrepreneurship and Spin-offs. Supervision of the Services AG, IBH, RH, SAL, and SCOM.

Gabriel David, Vice-Chairman – Strategic Partnerships – Associates and Higher Education Institutions; Institutional Governance; Institutional Bases and Policies: Rights and Duties, Researcher and Student Statutes, Data Protection; Advanced Training; Knowledge Management; Scientific Council.

Aníbal Matos, Member of the Executive Board – Coordination of Scientific Domains; Institutional Applications and Supervision of Cross-Cutting Projects – Science; Scientific Advisory Board; Students. Liaison with the Centres CRACS, CRAS, CRIIS, HASLab, HumanISE, and LIAAD. Supervision of the Services SAAF and SRI.

Clara Gouveia, Member of the Board – Industry Partnerships; Promotion of the R&D Services and Consulting Area; Liaison with Participations in Other Entities; Institutional Applications and Supervision of Cross-Cutting Projects – Innovation; Business Advisory Board.

Lia Patrício, Member of the Board – Internal Digital Transformation; Knowledge Transfer in the Digital Era; Ecosystem Orchestration for Societal Challenges; Citizen Engagement.

Luís Seca, Member of the Executive Board – Coordination of TEC4; Environmental Sustainability; Quality Management; Non-Legal Compliance and Operational Risk Management; Project Management Office; Management Training and Leadership Development; Institutional Bases and Policies: Social Responsibility. Liaison with the Centres CAP, C-BER, CEGI, CESE, CITE, CPES, and CTM. Supervision of the Services SAS, SIG, SRC, and SGI.

Maria da Graça Barbosa, Member of the Executive Board – Legal Compliance and Risk Management; Institutional Bases and Policies: Ethics, Conflicts of Interest, Diversity and Inclusion. Supervision of the Services AJ, CF, CG, and CSECR.

2.5 Research

Research at INESC TEC is centred around eight broad Scientific Domains. Researchers across INESC TEC come together in each domain to establish a critical mass of scientific competences and enhance scientific cohesion, strategy, impact and communication. These forums enable discussing and planning INESC TEC's longer-term research trajectory, becoming platforms for strategising, with medium to long-term goals leading to measurable results.

The institution’s scientific strategy in each domain is fully articulated with the strategies of the R&D Centres, the organisational units that effectively plan, manage, and carry out the research activities at INESC TEC. INESC TEC’s R&D Centres-based model is at the root of its sustainable growth and distinctive multidisciplinary nature.

Today’s Grand Challenges, such as resilient responses to climate change, the decarbonisation and digitalisation of the economy, or the design of sustainable circular solutions, business models and value chains, present demanding multidisciplinary research challenges. INESC TEC draws on the expertise of its scientists in different fields to assemble multidisciplinary teams to tackle large-scale, time-sensitive projects addressing such critical social and economic challenges quickly and successfully with lasting impacts. To this end, four thematic lines that embrace scientific challenges that crosscut our scientific domains and are decisive to our vision were identified: digital models, sustainable transformation, tackling the extreme, and trustworthy technology.

This INESC TEC hallmark stems from its diversity, critical mass, and intrinsic purpose to cover the entire knowledge value chain. The joining of internal efforts is a crucial enabler for the higher impact of research achievements.

2.6 Innovation

Contemporary societies face multiple major social, economic, political, and cultural issues – societal challenges such as climate change, increasing demographic imbalances, shifting health challenges, shaped by contemporary megatrends such as technological advancements, growing energy needs, hyperconnectivity.

The sciences and technologies underlying digitally-enabled systems have a vital role in addressing these challenges, and INESC TEC has been fully committed to that endeavour, defining five main areas of intervention in the innovation arena:

- Market-pull innovation in which it aligns its strategy with relevant challenges of the main economic sectors;
- Large-scale innovation strategies to increase the level of intervention and impact, from sectors to societal challenges;

- Knowledge management and valorisation paving the way to take full advantage of the cross-sectorial nature of its research results;
- Entrepreneurship support to boost scientific knowledge valorisation and upgrade Portugal's economic fabric;
- Advanced training and capacitation to develop the conditions for adequate knowledge transfer, absorption, and transformation into impactful innovations.

Addressing the first area of intervention, INESC TEC created the TEC4 ("TEChnologies FOR ...") internal initiatives as an organisational approach aiming at structuring and promoting the market-pull innovation process, targeting specific economic sectors. Each TEC4 addresses the market's regional, national, international, or global/societal challenges by mapping and linking its short, medium, and long-term needs (strategic agenda and roadmap) with INESC TEC's scientific and technological competences and experience.

In line with the above innovation strategy, as a Technology and Innovation Centre recognised by the Portuguese Ministry of Economy, its pluriannual action plan to promote science-based innovation with economic and social impact spans across eight axes: Networking and promoting new projects in companies; Promoting technology transfer and cross-fertilisation; Internationalisation; Strengthening and boosting technological infrastructures; Attracting and developing talent; Digitising processes and continuous improvement; Sustainability and budget predictability; Developing relevant knowledge and technology in the circular economy and decarbonisation, artificial intelligence and cybersecurity.

2.7 Strategic Commitments

To accomplish its vision, INESC TEC has defined the following five core strategic commitments:

C1. Excel and innovate across the missions of academia, harnessing the collective strength of our community.

C2. Make an impact on the toughest challenges of our time in science, technology, and society, through bold creativity and transformative action.

C3. Increase our relevance by closely integrating across science and innovation, disciplines, and ecosystems.

C4. Cultivate an attractive, people-centred and talented community.

C5. Strive for a sound, sustainable and effective operational model.

Excel and innovate across the missions of academia, harnessing the collective strength of our community

INESC TEC will address significant challenges, such as the UN's Sustainable Development Goals, the EU's Societal and Grand Challenges, or the US National Academy of Engineering's Grand Challenges, through transformative science and technology. In service of public interest, it will contribute to implementing current policy priorities and help shape future policies addressing critical societal challenges. The institute combines creativity and freedom with action, maintaining a constant focus on excellence.

Strategic objectives to address this commitment span from raising the contribution and visibility of research, namely by increasing the involvement in the leadership of scientific initiatives, to improving the base conditions for technology commercialisation and developing closer and deeper relationships with innovation partners and the broader community. Other objectives, such as providing innovative learning experiences, increasing international embedment, reinforcing strategic alignment, and ever-closer collaborations with Higher Education Institutions (HEI), are also key priorities.

Make an impact on the toughest challenges of our time in science, technology, and society, through bold creativity and transformative action

INESC TEC will take on the toughest challenges through transformative science and technology. It will work hard, acting in the public interest, contributing to implementing current policy priorities and shaping future policies tackling critical societal challenges. It will be boldly creative, blending novelty, freedom, and action through endeavour and a relentless focus on excellence.

To that end, the institution's strategic objectives focus on increasing its contribution to regional and national R&I-based sustainable growth, better aligning the delivery of R&I with the industry's needs and the SDGs. Furthermore, it will contribute to the digitalisation of public administration and raise its involvement in informing debates on issues that matter to society. Finally, it will endeavour to engage in direct dialogue with the public and to communicate scientific and technological achievements and their impact.

Increase our relevance by closely integrating across science and innovation, disciplines, and ecosystems

The institution will act in an integrated manner across the knowledge value chain, researching and developing technology-based systems and fostering sustainable innovation. Its paths to solutions will build on an integrated multidisciplinary approach. Striving for impactful innovation, jointly with its stakeholders, it will strengthen the technology and innovation capabilities of the ecosystems it is a part of.

To fulfil this commitment, INESC TEC's primary goals are to build more vital knowledge-based and multidisciplinary R&I ecosystems and to develop better linkages between knowledge production, development, and market uptake. Moreover, initiatives will be undertaken to increase strategic integration in national and international tech-intensive value chains and promote proactive participation in R&I agenda-setting at regional, national and EU levels. It will aim to expand its international networking, leadership, and competitiveness.

Cultivate an attractive, people-centred and talented community

INESC TEC will strive to attract and retain world-class talent, by motivating, recognising, and fully supporting individuals in their personal and professional growth. It will expand the diversity of its talent and be a welcoming home for international researchers, cultivating an inclusive and freethinking environment. It will promote a good working environment, fostering team spirit, engagement, and social responsibility. It will uphold openness, transparency, independence, and ethical principles in research.

The strategic objectives for this commitment encompass attracting and retaining world-class talent and ensuring opportunities and recognition for career achievements. In addition, they also entail expanding the diversity of INESC TEC's community, providing a more dynamic and fulfilling working environment, and, finally, strengthening the institution's commitment to independence and compliance of research with ethical principles.

Strive for a sound, sustainable and effective operational model

The institute will endeavour for sustainability and resilience in its economic model, providing its community with the best conditions to create new knowledge that will impact society. It will promote and contribute to environmental sustainability, provide excellent facilities, and cultivate a discovery and learning environment, enabling its critical talent community to thrive.

This commitment's strategic objectives include strengthening the sustainability and resilience of INESC TEC's economic model, the improvement, management, and usage of its infrastructures and, to a more significant degree, cementing the distinctive aspects of its institutional model.

3 RESULTS ACHIEVED IN 2025

This section presents a short summary of the results INESC TEC achieved during 2025, including highlights of the activity.

3.1 The Year 2025 in Review

The year 2025 unfolded in a complex and evolving global context, shaped by ongoing geopolitical tensions, accelerating technological change, and increasing pressure to address environmental and societal challenges. The persistence of the conflict in Ukraine, continued instability in the Middle East, and the broader geopolitical repositioning of major global actors reinforced a multipolar landscape, with significant implications for international cooperation, security, and economic resilience. In Europe, these dynamics further strengthened policy priorities around strategic autonomy, fostering closer alignment between civil and defence research agendas and reinforcing the focus on industrial competitiveness and technological sovereignty, supported by sustained investment in key programmes and initiatives.

At the same time, technological transformation advanced at an unprecedented pace, with artificial intelligence, data-driven systems, and digital infrastructures becoming increasingly pervasive across sectors. While creating new opportunities for innovation and economic growth, these developments also raised important challenges related to regulation, ethics, skills, and the broader societal impact of emerging technologies. In this context, the growing emphasis on responsible innovation, open science, and digital governance further highlighted the role of research organisations in shaping both technological progress and public policy.

Environmental sustainability remained a defining global priority. The intensification of climate-related risks, combined with growing awareness of resource constraints and energy dependencies, accelerated the transition towards more sustainable and resilient systems. This shift was reflected in stronger commitments to clean energy, circular economy approaches, and sustainable innovation, with research and technology playing a central role in enabling this transformation.

Within this context, INESC TEC continued to strengthen its position as a key actor in the national and European research and innovation ecosystem. The institute sustained its growth in activity and community, reinforcing its capacity to deliver impactful research, foster collaboration, and respond to societal challenges. This trajectory was supported by strong participation in major funding instruments, including PRR, PT2030, and Horizon Europe, enabling the development of strategic initiatives and partnerships across multiple domains.

At the same time, 2025 stood out as a particularly significant year, combining sustained growth with reinforced scientific recognition, notably through the excellent evaluation achieved in the FCT R&D Units assessment, and increased visibility at European level. Institutional development was further strengthened through investments in organisational capacity, infrastructure, and talent. The institute also expanded its international engagement, deepened collaboration with industry and public sector partners, and reinforced its role in emerging strategic areas, as well as in knowledge transfer and valorisation.

Despite a context marked by uncertainty and rapid change, 2025 confirmed INESC TEC's ability to adapt, grow, and generate impact. Marking four decades of activity, the institute's 40th anniversary provided an opportunity to reflect on its trajectory, consolidate its identity, and reaffirm its commitment to addressing emerging societal challenges. Looking ahead, INESC TEC remains focused on strengthening its scientific excellence, fostering its community, and contributing to a more sustainable, inclusive, and technologically advanced society, in alignment with its strategic commitments and public mission.

3.2 Highlights in 2025

INESC TEC successfully advanced the core initiatives planned for 2025, with most being implemented as expected and some naturally adjusted in response to evolving circumstances. The year was marked by a 18% increase in activity, reflecting continued investment in strengthening the institute's foundations, deepening its engagement with national and international Science and Technology systems, and upholding its public mission.

This progress was supported by a combination of strategic continuity and institutional adaptability, enabling INESC TEC to respond effectively to emerging opportunities and challenges. Throughout the year, the organisation reinforced its capacity to generate impact across research, innovation, and societal engagement, while consolidating its role in the national and European R&I landscape. At the same time, 2025 was shaped by a broader moment of reflection and renewal, as the institute marked its 40th anniversary and projected its future ambitions from a position of strengthened institutional maturity.

INESC TEC 40th Anniversary: Celebrating Impact, Community, and Future Vision

The year 2025 was marked by the celebration of INESC TEC's 40th anniversary, a milestone that brought particular visibility to four decades of scientific excellence, innovation, and contribution to society. More than a commemorative programme, the anniversary became a defining element of the year, with a strong impact on both internal dynamics and external projection, reinforcing the institute's identity, culture, and positioning within the national and international R&I landscape.

A diverse set of initiatives engaged stakeholders across multiple dimensions. Externally, flagship events such as the 10th edition of the INESC TEC Autumn Forum, held at Casa da Música under the theme "Being Human in the Age of AI: Identity, Ethics, and Society in a Technological World", brought together more than 500 participants, the highest attendance to date, and fostered dialogue on the societal implications of emerging technologies. Outreach activities were further strengthened through the first INESC TEC Open Week, which welcomed 120 students, and through initiatives such as the colloquium "Camões, the Sea, Technology and Portuguese Science", promoting reflection on the intersection between history, science, and innovation. The anniversary programme also included community engagement actions, notably the "40 Years, 40 Trees" initiative, developed in partnership with Porto Municipality and Porto Ambiente, mobilising volunteers around environmental sustainability.

Internally, the commemorative programme played a key role in strengthening institutional cohesion and a sense of belonging. Dedicated events such as "40 Years, 40 Cakes" brought together different generations of the INESC TEC community in a celebration centred on people, shared memories, and collective identity, complemented by testimonial videos capturing the institution's evolution over time. As part of the anniversary celebrations, the Board of Directors also awarded the title of Chairman Emeritus to Pedro Guedes de Oliveira and José Manuel Mendonça, recognising their exceptional service, leadership, and lasting contribution to the Institute's identity and development. Established initiatives were also reinforced and adapted to increase participation, including INESC TEC on the Move, which recorded significant growth in engagement, the Strategic Meeting, which fostered collective reflection on the organisation's future, and the Season Party, which gathered more than 400 participants in a moment of recognition and celebration. Together, these initiatives contributed to reinforcing organisational culture, promoting intergenerational connection, and consolidating a dynamic and inclusive working environment.

Overall, the 40th anniversary celebrations not only honoured INESC TEC's legacy but also created a platform to reflect on its future trajectory, strengthening its role as a leading institution in science, technology, and innovation, committed to generating impact for society.

In the context of this milestone year, the following section presents the most significant accomplishments of 2025, structured according to INESC TEC's five strategic commitments. These achievements illustrate the ongoing implementation of the Strategic Plan, while not exhausting the full breadth of institutional activity. Additional cross-cutting initiatives, driven by the work of R&D centres, services, and internal commissions, are detailed in other sections of this report.

The Board of Directors would like to express its special acknowledgment and sincere appreciation to the Organising Committee of INESC TEC's 40th anniversary celebrations, chaired by Prof. João Peças Lopes, for the outstanding execution and for making this milestone truly memorable.

C1. Excel and innovate across the missions of academia, harnessing the collective strength of our community.

- C1.1. Raise the contribution and visibility of our research

INESC TEC reinforced its scientific positioning in 2025 through top-level national recognition, strategic reflection on its research agenda, continued investment in talent and advanced training, and a sustained commitment to high-quality scientific output, Open Science, and research data management:

- Top rating in FCT R&D Unit Evaluation – INESC TEC was awarded the highest classification of "Excellent" in the 2023/2024 Portuguese Foundation for Science and Technology (FCT) R&D Unit Assessment. As the second largest Portuguese institution to achieve this rating, this distinction confirmed INESC TEC's capacity to combine scientific excellence with economic and societal impact.
- Scientific Advisory Board engagement and strategic reflection – INESC TEC hosted the visit of its Scientific Advisory Board (SAB) in July 2025, promoting in-depth reflection on the institute's results in the FCT R&D Units Evaluation and on its scientific strategy at the start of a new multiannual cycle. The visit focused on six research domains - Bioengineering, Communications, Computer Science and Engineering, Photonics, Robotics, and Systems Engineering and Management. Preliminary feedback highlighted the institute's scientific progress while identifying opportunities to further strengthen domain strategies, reinforcing the SAB's role in guiding INESC TEC's long-term positioning.
- Strategic reinforcement of the research team – A targeted recruitment effort in key scientific areas led to an 18% increase in R&D employees with PhD, reinforcing INESC TEC's scientific capacity in alignment with its research strategy. This development was supported in particular by the implementation of the FCT-Tenure Programme, both through positions at Associate HEIs and through internal INESC TEC research positions
- Strengthening doctoral attractiveness and institutional capacity – INESC TEC reinforced its attractiveness to PhD candidates through a structured and multidimensional approach to doctoral education, including improvements in supervision practices, institutional partnerships, monitoring mechanisms and student engagement. Key developments included the consolidation of the PhD Representatives Committee, the launch of a pilot Expression of Interest call, and the strengthening of internal communication and of the institute's value proposition for doctoral candidates. These efforts were further supported by structured support to FCT PhD Scholarships, contributing to a more robust and sustainable doctoral talent pipeline.
- Academic engagement and talent development – INESC TEC continued to play a central role in graduate education, contributing to over 20 PhD programmes and engaging more than 390 PhD students and 570 Master's students through its collaboration with Higher Education Institutions (HEIs). This sustained academic involvement strengthened the research ecosystem and contributed to the attraction and developed new talent.
- Consistency in scientific output and selective high-impact contributions – In 2025, INESC TEC maintained a high level of scientific output, with a total of 932 indexed journal and conference publications (compared to 943 in 2024). Journal publications increased to 468 (from 461), while conference publications reached 464 (from 482), reflecting a more balanced distribution of outputs. While conference volumes declined slightly from the previous year, they remained at historically high levels. In terms of high-impact dissemination, 11 papers were presented at CORE A* conferences and the number of CORE A publications increased from 14 to 23, highlighting strong performance in top-tier conference venues.

- Advancing Open Science and research data management practices – In 2025, INESC TEC acted as one of the ten national centres for Research Data Management, contributing to the development of a national network for data management and sharing while promoting the adoption of FAIR principles. Leading a consortium with BIOPOLIS and CIIMAR through the FAIRWay project, funded by FCT, the institute strengthened Open Science practices at both institutional and national levels. Key outputs included the development of institutional open data policies, structured training programmes, including a MOOC on the NAU platform, the publication of 30 FAIR-aligned datasets, and practical resources such as Electronic Lab Notebook (ELN) guidelines and a decision-based roadmap for Data Management Plans, reinforcing INESC TEC's leading role in the national research data stewardship ecosystem.

- C1.2. Increase our involvement in the leadership of scientific initiatives

  The institute strengthened its leadership in scientific and technological initiatives in 2025 through the launch of strategic national programmes, continued engagement in emerging digital technologies, and active participation in international and open-source innovation ecosystems:

  - POEMS – Portuguese Competence Centre in Semiconductors – In 2025, INESC TEC contributed to the launch of POEMS, the Portuguese Competence Centre in Semiconductors, a strategic initiative aligned with the European Chips for Europe agenda and involving a consortium of 16 partners. Officially launched in April 2025, POEMS aims to strengthen national capacity in semiconductor research, development and innovation, addressing Portugal's limited presence in this strategic sector. The initiative promotes collaboration between academia and industry through joint working groups, supports knowledge and technology transfer, and facilitates access to advanced tools and infrastructures. It also places a strong emphasis on skills development and requalification, with INESC TEC playing a key role in coordinating training activities aligned with industry needs. By reinforcing national and international synergies, POEMS contributes to positioning Portugal within the global semiconductor ecosystem.
  - Leadership in emerging digital technologies – INESC TEC maintained a central role in national and European initiatives in High-Performance Computing (HPC), Artificial Intelligence (AI), and Quantum Computing, reinforcing its scientific positioning in critical frontier technologies and contributing to the development of strategic capabilities in these domains.
  - Engagement in open-source energy innovation ecosystems – In 2025, INESC TEC became an associate member of Linux Foundation Energy (LF Energy), reinforcing its commitment to open-source solutions that accelerate the energy transition and strengthen European technological sovereignty. This engagement, marked by participation in the LF Energy Summit 2025, positioned INESC TEC within a global ecosystem promoting collaborative innovation for more resilient and sustainable energy systems, in alignment with the institute's broader mission in Open Science.
  - International engagement through the CENTRA network – INESC TEC strengthened its collaboration within the CENTRA network, a transnational platform for cooperation in cyberinfrastructure involving countries such as Indonesia, the United States, Vietnam, and Japan. In 2025, this engagement focused on advancing capabilities in supercomputing, data storage, and Artificial Intelligence, reinforcing the institute's

contribution to international collaborative research infrastructures in strategically relevant digital domains.

- C1.3. Improve the base conditions for technology commercialisation

  INESC TEC strengthened the base conditions for technology commercialisation in 2025 through reinforced patenting performance, stronger international positioning, improved support for industry engagement, and the consolidation of more structured pathways for entrepreneurship and spin-off creation:

  - Strengthened leadership in patenting and intellectual property generation – INESC TEC ranked 3rd nationwide in the number of European patent applications, according to European Patent Office data for 2025, marking its entry into the national top three and consolidating a consistent presence in the Top 10 since 2017. This performance was accompanied by a strong year in innovation scouting and IP generation, with around 70 new R&D results identified, the highest level in the past six years, and a significant increase to 19 first-priority patent filings. Two new European patents were granted in artificial intelligence and advanced imaging technologies, contributing to the expansion of the institute's active patent families to a record 56. Together, these results reinforce INESC TEC's strategy of transforming scientific knowledge into protected technologies with strong societal impact.
  - Strengthening international positioning in technology transfer – INESC TEC reinforced its external positioning and innovation network through the award of the 3rd Prize in the Impact Expected category at the EARTO Innovation Awards, marking its third consecutive distinction in this European forum. New agreements were also established with leading US and European universities and R&D organisations to formalise joint intellectual property development and collaborative efforts addressing global challenges. This positioning was further supported by active participation in international networks and fora, including the TTO Circle, where INESC TEC assumed leadership roles in open-source-related topics, as well as organisations such as ASTP and LES.
  - Strengthening industry engagement and commercialisation pathways – INESC TEC expanded its engagement with industry through increased outreach, validation activities, and interaction with specialised brokers, supporting the alignment of R&I outputs with market needs. In 2025, one commercial agreement in bioengineering was secured. While commercial outcomes remain uneven, these efforts, combined with enhanced analytical capabilities through Generative AI and improved data structures, are contributing to the development of more structured and scalable technology transfer processes.
  - Launch and consolidation of the Entrepreneurship and Spin-offs Office – INESC TEC established and consolidated the Entrepreneurship and Spin-offs Office (ESO) to foster innovation and entrepreneurship within its research community, support the development of deep-tech ventures, and strengthen the institute's capacity to translate research into impactful solutions. Key initiatives included the organisation of "Entrepreneurship Talks" and the launch of "Office Hours", providing structured support and early guidance to researchers exploring entrepreneurial pathways, as detailed in Section 10.

- Development of the entrepreneurial pipeline and spin-off ecosystem – ESO-supported activities led to the development of seven entrepreneurial projects in 2025. The Office also ensured continued support to existing ventures, contributing to milestones such as Seedsight's €1.8M funding round, while strengthening connections with international partners and venture capital firms, reinforcing INESC TEC's position in deep-tech entrepreneurship.
- Advancing technology commercialisation through spin-off creation – INESC TEC further strengthened the impact of its innovation activities through the creation of the spin-off KEPsoft CIC, developed in collaboration with three European partners: the HUN-REN Centre for Economic and Regional Studies (KRTK, Hungary), Óbuda University, and the University of Glasgow. Focused on improving kidney transplantation, the initiative exemplifies the institute's capacity to translate research outcomes into high-impact, societally relevant solutions. Its recognition with a podium position at the EARTO Innovation Awards 2025 further highlights the international relevance of this innovation.

- C1.4. Develop closer and deeper relationships with our innovation partners and the broader community

  In 2025, INESC TEC reinforced its engagement with innovation partners through sustained collaboration with industry, the co-development of solutions, and targeted initiatives that strengthened dialogue, trust, and long-term positioning within innovation ecosystems:

  - Strengthening engagement with innovation partners and industry ecosystems – INESC TEC reinforced its collaboration with industry through targeted initiatives and regular interaction with technology-based companies, including the second edition of the Energy Technology Open Day, which gathered around 200 participants and featured research pitches and technology showcases with leading partners. These activities contributed to fostering dialogue, identifying sectoral challenges, and consolidating the institute's role as a trusted partner in innovation ecosystems.
  - Development of industry-driven solutions and collaborative innovation – INESC TEC advanced its collaboration with innovation partners through the delivery of industry-validated solutions across multiple domains, including logistics optimisation, decision-support systems, and AI-driven applications. Developed in close cooperation with national and international partners, these initiatives demonstrate the institute's capacity to co-create high-impact solutions aligned with real-world challenges, strengthening long-term relationships and supporting the development of strategic research collaborations.

- C1.5. Provide innovative learning experiences

  The institute strengthened its educational ecosystem in 2025 through expanded advanced training programmes, flagship international schools, the structuring of doctoral education, and initiatives that reinforced talent pipelines and engagement with students and the broader community:

  - Expansion and diversification of advanced training programmes – INESC TEC delivered 22 advanced training programmes, strengthening its offer in areas such as innovation and technology management, sustainability, and operations. This included a new edition of the Executive Master in Cybersecurity, developed in collaboration with Porto Business School. Targeted initiatives addressed sector-specific needs, notably in healthcare and energy, including specialised training delivered to the European Commission's Joint Research Centre (JRC) on semantic interoperability, supporting the

digitalisation of the EU energy sector and reinforcing INESC TEC's role in capacity building and knowledge transfer.

- Flagship training initiatives in Artificial Intelligence and advanced communications – INESC TEC organised the second edition of "INVICTA – the INvicta School of VIsion, Computational Intelligence, and patTern Analysis", bringing together national and international participants from academia and industry to explore state-of-the-art developments and real-world applications in AI, computer vision, and pattern recognition. In parallel, the institute hosted the "SLICES-RI Summer School on Hands-On 6G", for the first time in Portugal, welcoming around 50 international participants and reinforcing its role in advanced training within European research infrastructures and next-generation communication technologies.
- Structuring doctoral education and research student support – The establishment of the Research Student Office marked a key step in developing the institutional conditions for high-quality doctoral education, including supervision practices, monitoring mechanisms, and internal coordination, as detailed in Section 10.
- Sustained engagement in PhD and Master's programmes – INESC TEC maintained its active involvement in graduate education, contributing to over 20 PhD programmes and engaging more than 390 PhD students and 570 Master's students through its collaboration with Higher Education Institutions. This sustained engagement strengthened the institute's capacity to attract and involve young talent in the development and dissemination of high-quality research.
- Record participation in the Summer Internship Programme – INESC TEC reinforced its talent pipeline through the Summer Internships Programme, offering a record 121 internships. Around one third of participants continued research collaborations, demonstrating the programme's effectiveness as a structured pathway for talent attraction and retention.
- Strengthening engagement with schools and science outreach initiatives – INESC TEC reinforced its engagement with schools and the broader community through participation in the National Forum of Clubes Ciência Viva na Escola, showcasing research with societal impact, including the Ecovale project on energy efficiency. This effort was complemented by initiatives such as the Open Week "Come and Discover the Wonderful World of Science and Engineering", hands-on laboratory activities for more than 100 students, and participation in the "Ciência Viva no Laboratório" programme, providing immersive research experiences for secondary school students. Together, these actions contributed to promoting scientific literacy, inspiring young talent, and strengthening early engagement with science and engineering.

- C1.6. Increase the international embedment of our community

  INESC TEC strengthened the international embedment of its community in 2025 through expanded mobility programmes, increased attractiveness to international researchers, deeper engagement in global research networks, and the development of institutional capacities to support international collaboration:

  - Expansion and consolidation of international mobility programmes – Participation in international mobility schemes was reinforced, supporting both inbound and outbound exchanges through programmes such as the NII International Internship Programme and funding instruments including Fulbright, La Caixa and Erasmus+. Tailored

communication and direct support increased researcher engagement, strengthening international exposure across the institute.

- Growth and consolidation of the International Visiting Researcher Programme – A new edition of the programme was launched, further establishing it as a flagship institutional mobility instrument. International visibility continued to grow, with applications surpassing one hundred and reflecting increasing attractiveness among global research communities.
- Strengthening of strategic international partnerships and collaborative initiatives – Collaboration with key partners was deepened through the launch of a second joint call for exploratory research projects with NIAR (Taiwan). Contributions to the EU–LAC Supercomputing Network for AI and the development of new mobility programmes with partners in India and Brazil further reinforced INESC TEC's participation in global research infrastructures and international collaboration networks.
- Reinforcement of institutional positioning in international networks – Active participation in platforms such as the CENTRA Operations Committee enabled closer engagement with research centres across Europe, Asia and the Americas, facilitating access to collaborative opportunities in cyberinfrastructure and advanced computing.
- Development of institutional capacity for internationalisation – Internal capabilities were strengthened through targeted initiatives, including the organisation of an International Negotiation training programme, the development of strategic documents and performance indicators in the area of internationalisation, and contributions to the establishment of an institutional research security framework supporting safe and responsible international collaboration.

- C1.7. Reinforce strategic alignment and close collaboration with HEI

  The institute reinforced its strategic alignment and collaboration with Higher Education Institutions through the formalisation and renewal of cooperation protocols, the development of joint academic and training programmes, and the strengthening of shared human and research capacities:

  - Formalisation of the INESC TEC hub at the University of Minho – A new cooperation protocol between INESC TEC and the University of Minho formalised the establishment of the INESC TEC hub in Braga, consolidating a long-standing partnership and reinforcing institutional collaboration. This milestone strengthens joint capacity in research and technological innovation, supporting the development of new collaborative opportunities and a shared strategic vision for the future.
  - Advancement of collaborative protocols with Associate HEIs – Work continued on the implementation of protocols with INESC TEC's Associate HEIs, supporting the shared use and strategic alignment of human and infrastructure resources across institutions and reinforcing the institute's collaborative institutional model.
  - Collaboration in advanced training programmes – INESC TEC maintained an active role in the design and delivery of Advanced Studies Programmes at several Associate HEIs, offering postgraduate training within the scope of R&D projects. These programmes combine hands-on experience with the development of transferable skills, including innovation, entrepreneurship, leadership, and time management, alongside specialisation in technological domains.

- Renewal and strengthening of collaboration with ISPUP – The cooperation protocol with the Institute of Public Health of the University of Porto (ISPUP), originally established in 2019, was renewed and expanded in 2025, reinforcing a long-standing institutional partnership. This collaboration continued to support the joint development of data protection procedures, improvements to information systems, and the definition of institutional policies, contributing both to compliance and to digital transformation efforts.
- Strengthening academic capacity through FCT-Tenure positions – The recruitment process for 22 professorships at Higher Education Institutions under the FCT-Tenure initiative was launched and progressed throughout the year, with positions being opened and filled in alignment with INESC TEC's strategic priorities. Co-funded by the institute and articulated with 14 permanent researcher roles at INESC TEC, these positions reinforced expertise in key domains such as Artificial Intelligence, Quantum Computing, Bioengineering, Robotics, and Energy Systems, strengthening synergies between academia and the institute's long-term research objectives.

C2. Make an impact on the toughest challenges of our time in science, technology, and society, through bold creativity and transformative action.

- C2.1. Develop impactful research and innovation aligned with the SDG

  INESC TEC reinforced the integration of the UN Sustainable Development Goals (SDGs) across its research and innovation agenda, embedding sustainability as a cross-cutting principle and contributing to systemic transitions in areas such as climate action, resource efficiency, sustainable industry, and societal well-being:

  - Alignment with the SDGs through the R&D project portfolio – A total of 364 active R&D projects at INESC TEC directly addressed one or more of the 17 UN Sustainable Development Goals, with particularly strong incidence in Affordable and Clean Energy (SDG 7), Industry, Innovation and Infrastructure (SDG 9), Good Health and Well-being (SDG 3), Life Below Water (SDG 14) and Life on Land (SDG 15). These figures reflect the institute's commitment to producing knowledge and solutions with clear societal relevance.
  - Advancing environmental sustainability and circular economy solutions – INESC TEC contributed to more sustainable production and resource efficiency through the development of advanced technologies for material classification, automated sorting, and waste reduction. These approaches support the transition towards circular economy models, improve recycling processes, and enable more efficient use of resources across industrial sectors.
  - Contribution to ocean sustainability and low-carbon maritime systems – Research activities supported the decarbonisation of the maritime sector and the protection of marine ecosystems, including the development of intelligent energy systems for vessels and technologies for the detection and monitoring of harmful elements in marine environments. These efforts contribute to more sustainable ocean operations and improved environmental governance.
  - Advancing marine ecosystem protection through robotic monitoring – INESC TEC developed and validated robotic and sensing technologies capable of detecting and locating abandoned fishing gear on the seabed, addressing a critical source of marine pollution. These solutions support more effective monitoring of marine environments

and contribute to the preservation of biodiversity and sustainable use of ocean resources.

- C2.2. Increase our contribution to regional and national R&I-based sustainable growth

  The institute reinforced its contribution to regional and national sustainable growth by supporting innovation ecosystems, collaborative structures, and strategic initiatives that connect research, industry, and public stakeholders across key sectors:

  - Strengthening regional innovation ecosystems in the Blue Economy – Contribution to the reinforcement of the Northern Portugal Blue Economy ecosystem by supporting the emergence of the €4.7M initiative "SUSTEMARE - Centre for Technology and Innovation in Ocean Energy and Technologies" initiative in Viana do Castelo, and the consolidation of the PREI – Plataforma Regional de Especialização Inteligente, promoted by CCDR-N, fostering regional coordination, specialisation, and sustainable innovation-driven growth.
  - Support for national innovation ecosystems – The institute supported the development and operation of 12 Clusters and 11 Collaborative Laboratories (CoLABs) in partnership with academia and industry. These initiatives are designed to bridge the gap between knowledge production and application, strengthen collaboration across sectors, and foster innovation-driven responses to complex societal challenges.

- C2.3. Better align and deliver R&I with industry's needs

  INESC TEC strengthened its alignment with industry needs through increased engagement with companies, the development of sectoral roadmaps, and enhanced capacity to deliver and demonstrate advanced technologies in collaboration with industrial partners:

  - Launch of TEC4COMMUNICATIONS and development of next-generation communications ecosystems – The TEC4COMMUNICATIONS initiative was launched to create an integrated innovation ecosystem connecting research organisations, industry, and public stakeholders in advanced communications. Progress included the strengthening of strategic partnerships, the approval of funding for the new Communications and Machine Perception Laboratory, and the definition of experimental capabilities for next-generation connectivity and sensing technologies, as detailed in Section 7.3. Together, these developments support technology transfer, the emergence of new services and business models, and the digitalisation of key economic sectors.
  - Expansion of R&D collaboration – INESC TEC secured new research and innovation contracts with both national and international clients, reflecting growing alignment with industrial priorities and increased trust in the institute's technological expertise. Flagship collaborations include work with leading companies such as IKEA and GE Vernova. In parallel, through dozens of projects under the Recovery and Resilience Plan (PRR), INESC TEC supported structural transformation across key sectors, including industry, energy, health, telecommunications, forestry, and agriculture.
  - Development of industry-oriented technology and sectoral roadmaps – INESC TEC supported companies and sectors through the design of strategic roadmaps addressing digital transformation, data governance, and decarbonisation. This included the definition of target architectures and phased implementation plans for industrial data systems, as well as contributions to sector-wide roadmaps, notably in the agro-food sector, promoting low-carbon transition, digitalisation, and circular economy

practices. These efforts provide structured guidance for translating strategic objectives into actionable projects and long-term transformation pathways.

- Strengthening capacity to deliver and demonstrate advanced industrial technologies – INESC TEC supported the development, testing, and demonstration of advanced manufacturing solutions, including robotics, digital twins, and optimisation tools. These activities reinforced the institute's ability to connect research teams, industrial partners, and real-world demonstration environments, strengthening its role in managing innovation processes and accelerating the adoption of emerging technologies in industry.
- Consolidation and expansion of the Industry Club – In 2025, the Industry Club was further developed as a structured platform for driving digital transformation in Portuguese industry, significantly expanding its reach to close to 500 members. Throughout the year, it hosted a diverse set of initiatives, including Masterclasses, Speed Summits and Open Days, promoting networking, visibility, and the exchange of practical experiences among industrial leaders, technology providers, and innovation stakeholders. The programme culminated in the "Voices of Industry" Conference, now established as its flagship annual event, reinforcing the Club's role in fostering collaboration, strengthening stakeholder engagement, and creating new opportunities within the Portuguese industrial ecosystem.

- C2.4. Contribute to the digitalisation of public administration

  INESC TEC strengthened its contribution to the digitalisation of public administration through closer policy collaboration and the development of digital solutions for governance and decision-making across civil and security domains:

  - Strengthening collaboration with PlanAPP on public policy and digitalisation – Engagement with PlanAPP - Centro de Competências de Planeamento, de Políticas e de Prospetiva da Administração Pública was reinforced through active participation in strategic initiatives and coordination fora focused on policy assessment and digital transformation. This included the launch of INESC TEC's involvement in the Public Administration Planning and Foresight Services Network (REPLAN), notably within the Monitoring Multisectoral Team, as well as participation in foresight and evaluation working groups.
  - Advancing the digitalisation of public administration and dual-use capabilities – INESC TEC strengthened its contribution to the digital transformation of public administration through the development and demonstration of advanced digital solutions in collaboration with public entities, defence organisations, and regional authorities. These included decision-support systems, digital governance models for smart territories, and technologies supporting operational planning, monitoring, and situational awareness. In parallel, dual-use innovations were showcased and adapted for defence and security contexts, including collaboration with the Portuguese Army and Navy, reinforcing the application of emerging technologies across civil and mission-critical domains.

- C2.5. Raise our contribution to inform debates on issues that matter to society

  INESC TEC strengthened its contribution to informing public debate by reinforcing its policy support structures, engaging in national and European policy processes, producing strategic position papers, and promoting evidence-based discussion through high-level events and expanded science communication:

- Restructuring of the Foresight and Public Policy Office – The Foresight and Public Policy Office were restructured to strengthen INESC TEC's capacity to engage with public policy processes and promote the effective use of scientific evidence in decision-making. This reorganisation enhanced institutional coordination and reinforced the role of foresight and policy support functions in connecting research outcomes with public bodies and policymakers, as detailed in Section 10.
- Autumn Forum reinforcing public policy debate – As a keystone initiative of INESC TEC's 40th anniversary celebrations, the 10th edition of the Autumn Forum, under the theme "Being Human in the Age of AI: Identity, Ethics, and Society in a Technological World", was held at Casa da Música, gathering over 500 participants. The event explored the intersection of artificial intelligence with society, ethics, and human values, reinforcing INESC TEC's role in public debate by bringing together diverse stakeholders to address inclusion, diversity, and responsibility in shaping technological futures.
- Policy input at the European level – Through the INESC Brussels HUB, the institute continued to contribute to European research and innovation policy development by preparing and submitting position papers and formal inputs to key initiatives, including FP10, the ERA Act, the European Innovation Act, and the EARTO FP10 consultation. It also engaged in discussions on Transparent AI Systems and in the OECD workshop on twin transitions, while ensuring representation in strategic European forums aligned with its research agenda and institutional priorities.
- Contribution to European policy on research and technology infrastructures – INESC TEC contributed to the European Commission's consultation on the strategic framework for Research and Technology Infrastructures (RTIs) through the development of a position paper proposing a more cohesive and integrated approach. The document emphasised the role of RTIs across the full innovation cycle, from advanced training to technological validation, and advocated for stronger governance, lifecycle funding, and inclusive access, reinforcing their contribution to scientific excellence, industrial competitiveness, and territorial cohesion.
- Contribution to European data policy through the Dataspaces Manifesto – INESC TEC published the Dataspaces Manifesto, a strategic document proposing approaches to ensure data sovereignty, security, and interoperability. The manifesto highlights the role of data spaces as a key enabler of the European Digital Single Market, promoting trusted data sharing, cross-sector integration, and sustainable economic growth through decentralised and interoperable data frameworks.
- Engagement in national science policy forums – INESC TEC remained an active member of the Council of Associate Laboratories and the CTI Alliance, contributing to the preparation of draft legislation and funding instruments relevant to the national research and innovation ecosystem.
- Contribution to system-level analysis of the Iberian Peninsula blackout – INESC TEC contributed to the analysis of the April 2025 Iberian Peninsula blackout through the development of a position paper providing a retrospective assessment and key lessons for power system resilience. The work highlighted the increasing complexity of grid operation in the context of the energy transition and reinforced the need for enhanced monitoring, control, and coordination mechanisms to ensure the stability and reliability of future electricity systems. This contribution was further amplified through two special editions of INESC TECWatch, delivering timely, evidence-based insights in both

energy and telecommunications, with the energy-focused edition becoming the most viewed to date.

- Support to public policy and regulatory development in the energy sector – INESC TEC contributed to evidence-based policymaking through analytical and regulatory support activities, including the assessment of economic and system-level impacts of renewable energy, the development of methodologies to support the integration of energy communities, and participation in initiatives promoting interoperability standards. These contributions also included comparative analyses of European regulatory frameworks, reinforcing the institute's role in informing policy and regulatory design in the energy domain.
- Expansion of science communication and policy-oriented dissemination – INESC TEC launched a new edition of the Science & Society magazine, alongside videocasts and podcasts aimed at broad audiences, promoting understanding of research and its societal impact. The seventh issue, dedicated to Artificial Intelligence and leadership, brought together 15 authors across nine articles under the theme "The responsibilities of responsible AI", fostering informed debate on the role of emerging technologies in shaping society and public policy.
- Extending research reach beyond specialised audiences – INESC TEC also expanded the visibility of its research beyond academic and technical communities, notably through its feature in Euronews' Food Detectives, which brought its work on tackling food fraud through advanced technologies to international mainstream audiences.

- C2.6. Engage in direct dialogue with the public

  The institute strengthened direct engagement with the public through science and cultural initiatives, national outreach events, demonstrators, and expanded communication presence reaching diverse audiences:

  - Engagement with the public through science and cultural dialogue – INESC TEC organised the colloquium "Camões, the Sea, Technology and Portuguese Science", bringing together diverse audiences to reflect on the intersection of history, science, and innovation in the ocean domain. Framed within the institute's 40th anniversary and inspired by the legacy of maritime exploration, the event fostered public dialogue on the future of the Blue Economy, highlighting the role of emerging technologies, such as marine robotics, in advancing sustainable ocean knowledge.
  - Engagement in national science outreach and public awareness initiatives – Active participation in events such as Ciência 2025 and Mostra U.Porto reinforced INESC TEC's visibility in national platforms connecting science and society. This was complemented by targeted initiatives including the International Day of Women and Girls in Science, National Scientific Culture Day, and Café de Ciência, creating meaningful opportunities to engage broader audiences and align scientific activity with societal dialogue.
  - Expansion of public engagement through demonstrators and high-visibility initiatives – INESC TEC increased the number of initiatives explicitly involving public engagement by organising and participating in demonstrations, pilot deployments, and public showcases across multiple domains. These included field trials, technology demonstrations, and participation in national and international events, promoting

direct interaction with citizens, industry, and stakeholders, and making the societal relevance of research and innovation more visible.

- Strengthening outreach and public engagement through communication and media presence – Public engagement was further reinforced through strong media and communication activity, with over 6,500 mentions, an estimated reach of 2.06 billion, and an Advertising Value Equivalent exceeding €11.8M. International press releases, multimedia production, and social media dissemination supported the visibility of research activities and broadened engagement with diverse audiences beyond traditional channels.

- C2.7. Communicate scientific and technological achievements and their impact

  INESC TEC strengthened the communication of its scientific and technological achievements through international conferences, expanded digital channels, public-facing initiatives, and participation in leading global events:

  - Hosting and organisation of international scientific conferences – INESC TEC hosted and co-organised several major international conferences, including "ECML-PKDD 2025", one of Europe's leading events in Machine Learning, which brought more than 1,300 participants to Porto. The conference featured a comprehensive programme, including a main scientific track, workshops, tutorials, applied data science sessions, industrial tracks, and journal collaborations with leading publications in the field. Additional high-profile events included the "OFS29 – Optical Fiber Sensors Conference", the "12th EurOMA Sustainable Operations and Supply Chains Forum", and "PRO-VE 2025", further reinforcing INESC TEC's role in convening international communities around topics such as sustainability, digital transformation, and collaborative networks.

  - Strengthening communication channels and digital outreach – INESC TEC expanded its communication ecosystem through publications, podcasts, videocasts, and digital platforms, promoting scientific results and their societal impact. This included new editions of Science & Society, INESC TECWatch, and Science Bits, alongside sustained growth in website traffic, newsletters, and social media communities.

  - Public-facing visibility through events and open-door initiatives – INESC TEC promoted summer schools, workshops, talks, and open days across its R&D Centres, welcoming participants from academia, industry, media, and society. These initiatives contributed to making research activities more visible and accessible, while reinforcing a culture of openness, transparency, and engagement with external audiences.

  - International presence and visibility – INESC TEC showcased its research and innovation at prominent international expositions and fairs. Highlights included participation in Transport Logistic in Munich, one of the world's largest logistics trade fairs, and ENLIT in Bilbao, Europe's leading energy event, alongside major international forums in robotics and autonomous systems such as ERF 2025 and REPMUS 2025. The institute also contributed to specialised events in maritime technologies and sustainability, reinforcing its positioning in international innovation ecosystems and promoting advanced solutions across industry, energy, agro-food and ocean domains.

C3. Increase our relevance by closely integrating across science and innovation, disciplines, and ecosystems.

- C3.1. Build stronger knowledge-based and multidisciplinary R&I ecosystems

  INESC TEC strengthened its role in multidisciplinary R&I ecosystems through the launch of new collaborative structures, deeper engagement in European and national innovation networks, the expansion of institutional affiliations, and a stronger contribution to shaping strategic research and policy agendas across interconnected domains:

  - Launch and initial operationalisation of INESCTEC.OCEAN as a multidisciplinary Centre of Excellence – INESC TEC launched and began coordinating INESCTEC.OCEAN, a Centre of Excellence in Ocean Research and Engineering, reinforcing the integration of scientific disciplines and ecosystems across marine domains. The initiative established a multidisciplinary R&I framework spanning marine structures, robotics, energy, and data, while fostering collaboration across academia, industry, and public stakeholders through strategic partnerships, international cooperation, and a dedicated stakeholder forum. Aligned with European priorities on ocean sustainability and supported by Horizon Europe Teaming funding, INESCTEC.OCEAN reinforces INESC TEC's role in building integrated, knowledge-based ecosystems and advancing innovation in the blue economy. In its first year, the initiative progressed through the formalisation of strategic partnerships with academic and international partners, the establishment of a stakeholder forum with more than 30 entities, and the development of collaborative frameworks with industry, as detailed in Section 9.
  - Support for Collaborative Laboratories (CoLABs) – INESC TEC maintained a strong presence in the national CoLAB landscape, participating in eleven Collaborative Laboratories in partnership with academia and industry. These initiatives aim to bridge research and societal needs by transforming scientific knowledge into impactful, mission-oriented innovation. A detailed overview of CoLAB activity is provided later in the next chapter.
  - Engagement in European innovation ecosystems – The institute maintained its involvement in EIT Manufacturing, a European Knowledge and Innovation Community (KIC), contributing to collaborative projects that promote advanced manufacturing capabilities and industrial competitiveness
  - Active role in European ecosystems for advanced materials innovation – Following its recent integration into the Innovative Advanced Materials Initiative (IAM-I), INESC TEC assumed an active role within this European ecosystem, which brings together more than 260 organisations across industry, academia, and research. In 2025, this included participation in its governance structures, notably through representation in the Association Delegation, contributing to the co-creation of strategic research and innovation priorities with the European Commission and supporting the development of multidisciplinary value chains for advanced materials.
  - Expansion of institutional affiliations – INESC TEC joined new national and international research associations, broadening its participation in strategic networks. These included CNCA - CENTRO NACIONAL DE COMPUTAÇÃO AVANÇADA, CURRENT/OS, Linux Foundation for Energy, OGC - OPEN GEOSPATIAL CONSORTIUM, SUSTEMARE - Centro de Tecnologia e Inovação em Energias e Tecnologias Oceânicas, and YEAR - YOUNG EUROPEAN ASSOCIATED RESEARCHERS.

- Strengthening influence in international R&I and policy ecosystems – INESC TEC also reinforced its role in international research and innovation ecosystems through active participation in key European and global associations and working groups. This included contributions to strategic agendas and position papers on digitalisation and artificial intelligence in energy systems, involvement in the co-creation of European priorities in smart grids and AI, and participation in standardisation and regulatory processes supporting the implementation of the AI Act. Together, these activities strengthened INESC TEC's influence in shaping multidisciplinary research agendas and policy frameworks at European level.

- C3.2. Develop better linkages between knowledge production, development, and market uptake

  In 2025, the institute strengthened the pathway from research to market through consolidated entrepreneurship support, enhanced technology valorisation, and increased capacity for venture creation and commercialisation, supported by large-scale innovation projects and internal capability building:

  - Consolidating entrepreneurship and venture creation pathways – The creation of the Entrepreneurship and Spin-offs Office (ESO) played a central role in nurturing deep-tech ventures, supporting the development of new entrepreneurial projects and strengthening the growth of existing spin-offs. This included early-stage guidance, investor engagement, and international partnerships, reinforcing INESC TEC's capacity to translate research into high-impact, market-ready solutions.

  - Strengthening the innovation pipeline from research to market – INESC TEC reinforced the link between knowledge production and market uptake by structuring its support mechanisms for technology valorisation, combining early-stage validation, market-oriented development, and venture creation. This effort was further supported by a broad portfolio of projects, including dozens under the Recovery and Resilience Plan (PRR), which enabled the demonstration and scaling of solutions across multiple sectors. Enhanced engagement with external stakeholders and the use of advanced analytical tools contributed to more scalable and structured technology transfer processes.

  - Advancing technology commercialisation through spin-off creation – The creation of KEPsoft CIC, developed in collaboration with three European universities and focused on improving kidney transplantation, exemplifies INESC TEC's ability to translate research into societally relevant innovation. Its recognition with a podium position at the EARTO Innovation Awards 2025 further highlights the international relevance and impact of this venture.

  - Strengthening capacity in knowledge transfer and open-source governance – INESC TEC reinforced its internal capabilities in innovation and technology transfer through structured training activities in intellectual property and open-source software, reaching more than 60 participants, and by contributing to the advanced training of PhD students through a new course on Innovation Management and Knowledge Transfer. This was complemented by key governance milestones, such as the first transfer of an open-source project to the Linux Foundation and the development of institutional guidelines and onboarding frameworks for open-source practices. Together, these efforts strengthened the institutional conditions for more effective knowledge transfer and innovation uptake.

- C3.3. Increase strategic integration in national and international tech-intensive value-chains

INESC TEC strengthened its integration in tech-intensive value chains through active participation in national and European initiatives, combining ecosystem development with technological leadership in strategically relevant domains:

- Strengthening integration in semiconductor and cyber-physical systems value chains – Active involvement in national and European initiatives, including POEMS and collaborations under the Chips Joint Undertaking, reinforced INESC TEC's integration in strategic semiconductor value chains. Activities spanned areas such as chip design, RISC-V architectures, embedded systems, and advanced computing platforms, combining ecosystem development with technological leadership. This included participation in European project proposals, the development of open-source EDA tools, and engagement with industry and international technical communities, contributing to a more connected, competitive, and innovation-driven semiconductor ecosystem.

- C3.4. Promote our pro-active participation in R&I agenda-setting at regional, national and EU level

  The institute strengthened its role in research and Innovation agenda-setting through contributions to European policy, regulatory frameworks, and strategic initiatives, combined with high-level institutional engagement aimed at aligning research with public priorities:

  - Contribution to European agenda-setting on AI in energy systems – Active participation in workshops under the Testing and Experimentation Facilities (TEF) initiative supported the development of a European strategic roadmap for artificial intelligence in the energy sector. This engagement led to the co-creation of the Plan4EUAI roadmap, proposing a structured approach for foundation models to support applications such as forecasting, optimisation, and digital twins of electricity grids, reinforcing INESC TEC's influence in shaping EU research and innovation priorities at the intersection of AI and energy.

  - Contribution to AI governance and regulatory frameworks – Active involvement in European regulatory processes supporting the AI Act was reinforced through participation in consultations and standardisation efforts, particularly on transparency, accountability, and governance of generative AI systems, contributing to the development of trustworthy and responsible AI frameworks.

  - Positioning in European data and research policy through strategic contributions – Publication of the *Dataspaces Manifesto* and the development of proposals for a more cohesive European strategy on research and technological infrastructures reinforced INESC TEC's role in debates on data sovereignty, interoperability, and long-term coordination of R&I capacities across Member States.

  - Engagement in European strategic dialogue on autonomy and competitiveness – Participation in the European Parliament Task Force on Widening and co-organisation of a high-level policy event in Brussels with key European institutions reinforced INESC TEC's involvement in discussions on strategic autonomy, dual-use technologies, and the future of Europe's research and innovation landscape.

  - Contribution to European agenda-setting on start-ups and scale-ups – Input to the European Commission's consultation on the future strategy for start-ups and scale-ups advanced proposals to address key barriers to growth, including access to finance, regulatory complexity, and market entry challenges. Recommendations focused on more flexible proof-of-concept funding, simplified investment conditions, strengthened collaboration between research and entrepreneurship, and enhanced support

infrastructures, reinforcing INESC TEC's contribution to policies aimed at boosting deep-tech innovation and competitiveness in Europe.

- Contribution to international agenda-setting in ocean digitalisation and governance – Active engagement in international standardisation and policy fora, including participation in the IEEE P3501 Digital Twins of the Earth Working Group and collaboration with global initiatives under the UN Decade of Ocean Science, reinforced INESC TEC's positioning in shaping emerging agendas on ocean digitalisation. This was complemented by contributions to United Nations discussions on marine technology transfer and capacity building, supporting the development of global frameworks for sustainable ocean governance.
- Engagement with national authorities on R&I priorities and policy alignment – Visits from key national authorities, including the President of the National Commission for Monitoring the PRR and the Secretary of State for Fisheries and the Sea, enabled direct dialogue on the role of research and innovation in economic transformation and sectoral strategies. These interactions combined institutional briefings with *in situ* demonstrations of technologies and infrastructures, showcasing contributions to areas such as business innovation, technology transfer, and the Blue Economy. They also create opportunities to align scientific capabilities with public policy priorities, inform the implementation of national programmes such as the PRR, and support the definition of strategic initiatives relevant to Portugal's positioning in key domains.

- C3.5. Increase our international networking, leadership and competitiveness

  INESC TEC strengthened its international networking, leadership, and competitiveness through deeper engagement in European policy processes, strategic programme coordination, and the expansion of global partnerships and collaborative networks:

  - Consolidation of the INESC Brussels HUB as a strategic European engagement platform – In its fifth year of operation, the INESC Brussels HUB strengthened its role as a strategic engine for European positioning, supporting engagement in key policy processes such as the design of FP10, the European Competitiveness Fund, and the new Multiannual Financial Framework. Through sustained policy analysis, strategic communication, and high-level institutional interaction in Brussels, the HUB reinforced INESC TEC's credibility and visibility within the European R&I ecosystem. Enhanced internal coordination mechanisms, including structured intelligence flows and project management practices, alongside active participation in expert evaluations and networking activities, enabled a more proactive contribution to policy design and improved capacity to anticipate and leverage European opportunities, as detailed in Section 10.
  - Organisation of high-level European policy dialogue on R&I priorities – The co-organisation of the INESC Brussels HUB Winter and Summer Meetings brought together policymakers, research organisations, and funding bodies to discuss strategic priorities such as research infrastructures, strategic autonomy, and dual-use R&I. Held in Porto and Brussels, these events gathered more than 200 participants including key representatives from the European Commission, ESFRI, and national authorities, fostered structured dialogue and contributing to policy reflection on future European programmes and governance frameworks.
  - Strategic coordination of the UT Austin Portugal Program – In 2025, INESC TEC continued to act as host institution of the UT Austin Portugal Program, providing

strategic, operational, and governance support to the partnership between FCT and The University of Texas at Austin. The year marked a phase of consolidation and recalibration, including contributions to the definition of a new governance model, the launch of advanced training and innovation initiatives such as the Training Academy and TechLaunch, and the expansion of research and mobility instruments. These efforts reinforced the programme's impact in research, education, and innovation, as well as its contribution to Portugal's international positioning in science and technology, as detailed in Section 9.

- Broadened institutional engagement in international organisations – INESC TEC actively participated in more than 25 international organisations, expanding its geographic reach and contributing to collaborative initiatives in diverse scientific and technological domains.
- Expansion of strategic partnerships in advanced computing and global research infrastructures – International collaboration was reinforced through renewed and new partnerships with leading R&D institutions, including AIST (Japan) in advanced computing and high-performance computing, and through participation in the development of the EU-LAC Supercomputing Network. These initiatives strengthened cooperation across Europe, Latin America, and Asia, supporting joint research, mobility, and the development of large-scale infrastructures and AI-driven applications addressing societal challenges.
- Strengthening international collaboration in the ocean domain – Strategic engagement in global ocean research and innovation ecosystems was reinforced through partnerships with organisations such as SINTEF Ocean, EMSA, ISA, and UN-related initiatives, as well as multilateral collaboration with Centres of Excellence in Cyprus (CMMI) and Croatia (MARBLE). These partnerships advanced joint R&D agendas in areas including marine robotics, ocean energy, environmental monitoring, and digitalisation, contributing to sustainable ocean governance and innovation.
- Development of transatlantic and bilateral cooperation in energy and technology – New and ongoing collaborations with institutions such as New Mexico State University supported joint research, advanced training, and researcher mobility in energy systems and related domains. These partnerships fostered knowledge exchange, co-development of R&D activities, and the preparation of joint project proposals, strengthening international scientific cooperation.
- Consolidation of INESC P&D Brasil – The institute continued to support the stable growth and operation of INESC P&D Brasil, reinforcing its footprint and collaborative presence in Latin America.

C4. Cultivate an attractive, people-centred and talented community.

- C4.1. Improve attraction and retention of world-class talent

  INESC TEC strengthened its capacity to attract and retain talent through the reorganisation of its Human Resources Service, targeted recruitment initiatives, and actions to reinforce its employer positioning and outreach:

  - Restructuring of the Human Resources Service and development of a new job descriptions and competency framework policy – In 2025, the Human Resources Service underwent a reorganisation, including the appointment of new leadership and the structuring of dedicated areas of activity to improve clarity, responsiveness and

effectiveness. Work also began on the definition of a new job descriptions and competency framework policy, which will provide a stronger basis for future organisational adjustments reinforce the institute's capacity to manage and develop human capital.

- Strengthening attraction and retention of top talent through FCT-Tenure – The implementation of the FCT-Tenure Programme supported the recruitment of new professorships at Higher Education Institutions, articulated with permanent research positions, reinforcing capacity in strategic domains such as Artificial Intelligence, Quantum Computing, Bioengineering, Robotics, and Energy Systems. This initiative also contributes to strengthening long-term talent retention and closer integration between academia and research.
- Enhancing employer attractiveness and talent outreach – The development of a standardised institutional job offer template improved the clarity, consistency, and professionalism of recruitment processes, while participation in initiatives such as "*Geração (IM)Provável"* strengthened visibility among younger generations, reinforcing positioning as an employer of choice and supporting the attraction of future talent.

- C4.2. Ensure opportunities and recognition for career achievements

  In 2025, the institute reinforced the institutional conditions supporting career development and recognition by aligning its practices with European frameworks and contributing to the advancement of more attractive and sustainable research careers:

  - Participation in European initiatives to improve research career frameworks – Engagement in the European Commission's Mutual Learning Exercise on Research Careers enabled the exchange of best practices with organisations from 16 countries on topics such as recruitment, working conditions, career progression, and talent circulation. This participation supported the alignment of INESC TEC's HR policies with European recommendations, contributed to the recognition of existing good practices, and reinforced efforts to create more attractive, sustainable, and supportive research career environments.
  - Leadership in shaping research career development frameworks – Active involvement in the creation of the HR4EXCELLENCE Portugal Community of Practice established a national platform to promote the implementation of the HR Excellence in Research Award. This was complemented by the preparation and coordination of the European proposal REALISE, bringing together 20 partners to advance collaborative approaches to improving research careers, reinforcing INESC TEC's role in structuring and advancing career development practices at national and European levels.
  - Promoting opportunities and recognition for early-career researchers – The launch of BEAR (Boosting EArly-stage Researchers), alongside INESC TEC's adherence to the European YEAR network (Young European Associated Researchers), established new avenues to support researchers at early stages of their careers. This initiative fostered professional development, collaboration, and institutional engagement by enabling participation in European networks, strengthening transversal and strategic skills, and promoting the exchange of experiences and good practices. By creating a dedicated space for this community and enhancing its institutional representation, BEAR contributes to improved career development opportunities and increased visibility and recognition of early-career researchers within and beyond INESC TEC.

- C4.3. Expand the diversity of our community

  INESC TEC reinforced the diversity and international profile of its community by expanding mobility opportunities, attracting global talent, and strengthening internal initiatives promoting inclusion and equality of opportunity:

  - Expansion and diversification of international mobility opportunities – Participation in international mobility programmes was reinforced through initiatives such as the NII International Internship Programme and short-term research internships with partners including The University of Texas at Austin and McGill University. Additional efforts included the design of new mobility schemes with partners in regions such as Asia and Latin America, contributing to increased researcher exchange, stronger international collaboration, and a more globally connected and diverse research community.
  - Expansion and diversification through the International Visiting Researcher Programme – A new edition of the International Visiting Researcher was launched, reinforcing its role as a key institutional mobility initiative. The continued rise in international applications, exceeding one hundred, reflects its growing global reach and attractiveness, contributing to a more diverse and internationally connected research community.
  - Support for diversity and inclusion initiatives – INESC TEC also reinforced the work of its Diversity and Inclusion Commission, with continued attention to areas such as gender equality, interculturality, accessibility, and age diversity. Further details on these initiatives are provided in Section 10.

- C4.4. Provide a more dynamic and fulfilling working environment

  The institute strengthened its working environment through initiatives aimed at improving employee experience, well-being, organisational culture, and the quality of physical and digital workplaces. These efforts combined investment in infrastructures and support systems with actions promoting inclusion, engagement, and internal cohesion:

  - 40th anniversary celebrations reinforcing institutional culture and employee engagement – The commemorative programme marking INESC TEC's 40th anniversary brought together a wide range of internal and external initiatives, fostering participation, team cohesion, and a strengthened sense of belonging. Activities such as community volunteering actions, institutional events, and enhanced team-building formats contributed to celebrating collective achievements, promoting intergenerational connection, and reinforcing a dynamic and inclusive working environment.
  - Enhancement of physical workspaces and collaboration infrastructure – Targeted investments were made to improve working conditions and support hybrid collaboration, including the installation of acoustic booths for web meetings, upgrades to videoconferencing systems across meeting rooms and auditoria, and infrastructure improvements at multiple sites. These included works at the University of Minho centre in Braga and a major upgrade of the CRAS facilities at ISEP, with the addition of a mezzanine and improvements to technical systems, contributing to more functional, comfortable, and collaborative work environments.
  - Strengthening wellbeing, inclusion, and community engagement – A broad set of initiatives promoted a more supportive and inclusive working environment, combining mental health awareness actions, diversity and inclusion programmes, and community engagement activities. These included training and events on wellbeing and gender equality, the launch of tools to assess workplace health conditions, and participation in

international networks for diversity capacity building. Cultural celebrations and institutional communication initiatives further supported inclusivity, while volunteering, donation campaigns, and outreach initiatives reinforced a strong culture of solidarity, employee engagement, and social responsibility.

- Enhancing employee experience through digitalisation and support services – The introduction of digital tools and streamlined processes, including QR code-based attendance systems and digital employee cards, contributed to a more seamless and efficient employee experience. These improvements were complemented by clearer communication and guidance on key topics such as remote work, benefits, and organisational procedures.
- Strengthening employee support, awareness, and wellbeing – Additional initiatives improved access to information and support, including guidance sessions on taxation and employment rights, communication of occupational health and safety requirements, and the development of a comprehensive health insurance guide. Partnerships through the corporate benefits platform further expanded employee access to support services and wellbeing-related resources.

- C4.5. Strengthen our commitment to independence and compliance of research with ethical principles

  INESC TEC reinforced its commitment to ethical research practices by strengthening internal governance structures and promoting critical implications of emerging technologies and research activities:

  - Support for internal ethics and compliance structures – The institute continued to support and empower its internal Commissions and Committees focused on ethics, conflict of interest management, social responsibility, data protection, and anti-corruption compliance. Detailed plans and activities are presented in Section 10.
  - Promoting awareness and critical debate on research ethics – The continuation of the Open Talks on Ethics in Research and Defence provided a structured platform to engage the research community in reflection on complex ethical challenges associated with emerging technologies. The 2025 cycle included three high-level conferences addressing topics such as humanism in a global context, the ethical implications of AI in warfare, and the responsibilities associated with military applications of AI in surveillance and reconnaissance. These sessions attracted strong participation and fostered meaningful dialogue, contributing to a more informed, responsible, and ethically aware research environment.

C5. Strive for a sound, sustainable and effective operational model.

- C5.1. Strengthen the sustainability and resilience of our economic model

  INESC TEC strengthened the sustainability and resilience of its economic model through diversified funding sources, stable multiannual support, continued growth in service revenues, and reinforcement of internal management systems:

  - Active participation in European programmes – INESC TEC submitted 153 proposals to the Horizon programme during 2025, alongside 2 proposals under the Digital Europe Programme and 15 proposals to the European Defence Fund, reinforcing its presence across competitive funding instruments.

- Strengthening European funding strategy and capacity building – Ongoing efforts were undertaken to monitor and refine participation in European funding programmes, particularly Horizon Europe, with the aim of enhancing institutional competitiveness. These included targeted support and training initiatives for researchers, improving preparedness and alignment with strategic funding opportunities.
- Securing strategic multiannual funding for capacity building and research excellence – INESC TEC continued to benefit from stable multiannual funding instruments, including its role as a Technology and Innovation Centre (CTI), supporting capacity-building and market-oriented activities through a dedicated three-year programme running until 2026. This was complemented by strong performance in the national R&D units evaluation, ensuring significant funding under the 2025–2029 Multiannual Funding Programme, and reinforcing the institute's ability to sustain long-term research, innovation, and institutional development.
- Execution of PRR projects – The institute continued the implementation of 29 projects under Portugal's Recovery and Resilience Plan (PRR), including 22 mobilising agendas, 3 bioeconomy agendas, 3 agriculture agendas, and 1 infrastructure initiative, supporting national transformation priorities.
- Research and innovation services – INESC TEC delivered 134 projects providing direct services to national and international companies and public organisations, generating €3.9M in revenue and further strengthening the institute's economic sustainability.
- Implementation of a new ERP system – The deployment of a new ERP system, developed in collaboration with other INESC entities, was completed in 2025. Replacing the previous Accounting and Financial Information System, the new platform enhanced financial and administrative integration, improving efficiency, data consistency, and support for institutional management processes.

- C5.2. Promote and contribute to environmental sustainability

  The institute advanced environmental sustainability through measures aimed at improving energy efficiency and expanding renewable energy, while strengthening ESG reporting, global engagement and participation in innovation initiatives addressing global environmental challenges:

  - Improving energy performance and infrastructure sustainability – Energy certification of the Asprela buildings and targeted upgrades to energy systems, including the installation of a heat pump and optimisation of technical infrastructure, contributed to more efficient and sustainable building operations.
  - Expansion of renewable energy generation capacity – The addition of new photovoltaic panels increased on-site electricity production, supporting the transition towards cleaner energy sources and reinforcing the institute's commitment to more sustainable operations.
  - Upgrading infrastructure to support efficient research operations – The installation of a dedicated electrical panel for the data centre ensured a more reliable and efficient energy supply for high-performance computing needs, supporting the sustainability and robustness of research operations.
  - Strengthening ESG reporting and transparency practices – Efforts were reinforced to improve the structuring and communication of environmental, social, and governance

(ESG) information, contributing to greater transparency, accountability, and alignment with emerging sustainability reporting standards and stakeholder expectations.

- Engagement in global environmental innovation initiatives – Continued participation as an official nominator for the Earthshot Prize reinforced INESC TEC's commitment to supporting and promoting innovative solutions addressing global climate and sustainability challenges.

- C5.3. Improve quality, management and usage of our infrastructures

  INESC TEC strengthened its research infrastructure ecosystem through the development of new strategic facilities, expanded access to specialised infrastructures, increased utilisation of existing assets, and targeted investments in equipment and digital capacity:

  - Launch of construction of the Leixões Blue Hub (HAL) – The construction phase of the Leixões Blue Hub (HAL) was officially inaugurated in April 2025, marking a major milestone in the development of this flagship infrastructure for the Blue Economy. Led by INESC TEC and implemented in partnership with APDL, the Municipality of Matosinhos, CIIMAR, INEGI, and Fórum Oceano, the project will deliver a state-of-the-art ocean basin at the Port of Leixões, positioning Portugal at the forefront of sustainable ocean engineering and digital maritime innovation and establishing one of Europe's largest marine technology test sites.

  - Access to new strategic infrastructure in the Blue Economy – Participation as a founding member of "SUSTEMARE - Centre for Technology and Innovation in Ocean Energy and Technologies" provides access to a new strategic infrastructure in ocean energy and technologies in Viana do Castelo, enhancing the institute's capacity to develop, test, and scale solutions in real-world environments. This initiative broadens the available infrastructure base and fosters closer integration with industry and regional innovation ecosystems.

  - Ongoing development of research infrastructure and laboratories – The institute maintained a programme of continuous investment and upgrades across its laboratories and research infrastructures. Selected highlights are presented in Section 12 of this report.

  - Operation and increased utilisation of the research vessel Mar Profundo – In 2025, the vessel recorded significant growth in activity, completing 59 mission days across European projects, external service provision, and internal operations, with 64% of its use supporting external communities. Missions included offshore energy surveys, marine ecosystem monitoring, and environmental assessment of coastal waters, highlighting its role in supporting the Blue Economy. The vessel also participated in the REPMUS 25 international robotics exercise. A major upgrade was completed with the implementation of dynamic positioning capability, enabling more complex and demanding operations.

  - Support for offshore renewable energy testing – INESC TEC continued to support CEO – Companhia da Energia Oceânica, which manages a 4 MW offshore test zone in Aguçadoura, enabling the development and validation of marine renewable energy technologies at intermediate-to-high technology readiness levels (TRL 5–8).

  - Participation in the "EQUIPAR+2" programme to strengthen research infrastructure – Within the scope of the PRR-funded "EQUIPAR+2" initiative managed by FCT, INESC TEC submitted an institutional application that achieved the maximum evaluation

score, anchored in strategic infrastructures from the National Roadmap of Research Infrastructures, namely the Tec4Sea Infrastructure and the x-Energy Lab. Although the approved funding (€575k from a €4.4M request) was below the initial proposal, it will support the acquisition of key scientific equipment and the reinforcement of institutional computational capacity, contributing to the modernisation of infrastructures and the digital transformation of research activities, with implementation planned until mid-2026.

- C5.4. Strengthen the distinctive aspects of our institutional model

  In 2025, INESC TEC strengthened the distinctive features of its institutional model through organisational transformation, enhanced management and digital systems, and continued investments in Open Science and AI-driven institutional development:

  - Operationalisation of the Project Office integrating PMO and advanced management support – In 2025, the Project Office was expanded and consolidated, combining the implementation of a centralised Project Management Office (PMO) with the development of tools and processes to support project and institutional management. Key achievements included the definition of project management methodologies and templates, the rollout of training activities, the development of IT tools integrated into the IRIS system for project monitoring, and the launch of pilot projects across Centres. In parallel, new and adapted tools were implemented to support analytical accounting, financial control, and planning processes, particularly in alignment with the new ERP, enhancing institutional capacity for project oversight and decision-making.
  - Reinforcement of institutional identity, communication, and internal cohesion – The full deployment of the new visual identity, together with integrated communication campaigns, and high-participation internal initiatives, including anniversary celebrations and strategic meetings, strengthened institutional culture, visibility, and engagement across the organisation.
  - Modernisation of IT infrastructure and digital workplace services – Institutional IT systems were significantly upgraded through the implementation of a hybrid identity architecture ensuring a single authoritative user account across platforms, and the migration of approximately 2 000 mailboxes to Microsoft 365. These developments were complemented by enhancements in cybersecurity, device management, communication systems, and network infrastructure, contributing to a more secure, integrated, and efficient digital environment across the organisation.
  - Advancement of organisational transformation and internal efficiency – Strategic efforts were undertaken to improve internal processes and administrative practices, supported by continuous improvement initiatives across services and contributing to greater operational robustness. Phase I of the “Simplifying Work @ INESC TEC” programme was also launched, establishing the basis for a broader institutional approach to process redesign. In parallel, the uONEConnect platform was consolidated as a central tool for project monitoring and governance, introducing enhanced dashboards, risk and benefits reporting, and new tools to support project execution across the full life cycle. These developments were reinforced by the full implementation of the ERP system, enabling greater integration of financial, administrative, and operational processes across the organisation.
  - Operationalisation of the Open Science task force – With direct sponsorship from Board members, the Open Science task force fostered structured engagement with the scientific community through a dedicated workshop and survey, enabling the assessment of current practices and the identification of priority areas for evidence-based action across the Centres.

- Advancement of digital transformation driven by AI and Open Science – Also with direct sponsorship from Board members, the development of an internal Artificial Intelligence initiative supported alignment between strategic priorities and emerging AI-driven research opportunities reinforcing the institute's commitment to combining digital transformation with distinctive scientific and organisational capabilities.

In addition, the following recognitions and achievements deserve special mention:

- Recognition as AEP Honorary Member – INESC TEC was distinguished as Honorary Member by the Portuguese Business Association (AEP), recognising its contribution to the national business ecosystem and to Portugal's economic and social development. This distinction reinforces the Institute's impact, visibility, and strong connection with industry.
- IEEE Fellow elevation – Ricardo Bessa was elevated to IEEE Fellow, one of the highest global distinctions in engineering, recognising his pioneering contributions to renewable energy forecasting and decision-support systems, with significant impact on energy systems worldwide.
- ERCIM Cor Baayen Award – Miriam Seoane Santos became the first Portuguese researcher to receive this prestigious international award, recognising outstanding contributions to data quality and ethical AI, with broad societal impact across critical sectors.
- Amazon Research Award – Alexandra Mendes received this prestigious international distinction, reinforcing the relevance of her work in verification-aware programming languages and trustworthy software systems.
- Waterborne Awards (Economic Viability category) – The Mari4_YARD European project was recognised for advancing digitalisation and modular construction in shipbuilding, contributing to the transformation of the maritime industry.
- SNS JU Top-10 Key Achievements – The SUPERIOT project was recognised among the most impactful European initiatives, highlighting its contribution to advancing IoT technologies in healthcare.
- Arquivo.pt Award (1st place) – The platform "A minha região – o teu portal autárquico", developed by INESC TEC researchers Rúben Almeida, Sérgio Nunes, and Ricardo Campos, was awarded first prize at the Arquivo.pt Award, recognising its contribution to strengthening democratic access to public data and promoting transparency and civic engagement.
- Technology Transfer Award (Portuguese Robotics Society) – The mobile manipulator for container unloading was recognised for successfully translating robotics research into high-impact industrial applications.
- PEL Academia 2025 Award (APLOG) – The TacitRouting project was awarded for its innovative contribution to data-driven optimisation in logistics and last-mile delivery systems.
- FIRA World Robotics Competition (Silver Medal / 2nd place) – The Modular-E robotic platform achieved global recognition as one of the leading agricultural robots, reinforcing leadership in autonomous systems.
- Innovation Vanguard Awards (Finalist) – The Modular-E platform was shortlisted among leading global innovations, highlighting its strong potential for large-scale impact.
- +Sustainable Douro Distinction (IVDP) – The Wine4Cast project was recognised for its contribution to sustainable viticulture.
- PQHack 2025 (2nd place) – The Quantum SHEmulation team, in collaboration with INL, achieved second place in an international competition, demonstrating innovative approaches in quantum computing.
- BIP PROOF Award (University of Porto) – The WeFetal technology received support for prototype development and clinical validation, recognising its potential to improve prenatal care.

- IEEE Portugal Outstanding Master Thesis Award – Ana Catarina Gomes was recognised for her work on security in distributed machine learning systems.
- Vestas Award for Best Master's Thesis – Luís Rodrigues was distinguished for his work on collaborative forecasting using blockchain-based incentives in energy systems.
- ECIR 2025 Best Demo Paper Award – Luís Filipe Cunha, Nuno Guimarães, Ricardo Campos and Alípio Jorge were recognised for their demonstration paper at the European Conference on Information Retrieval, highlighting excellence in information retrieval research.
- SIGMOD 2025 Honourable Mention – The paper "CRDV: Conflict-free Replicated Data Views" was recognised at one of the world's top data management conferences, highlighting excellence in distributed systems research.
- European Funds Awards (Honourable Mention) – The Smart Farm 4.0 initiative was recognised for its impact in digital agriculture.
- Amélia de Mello Foundation Research Grant (Honourable Mention) – Rui Martins received an Honourable Mention, awarded by the President of the Portuguese Republic, recognising the societal relevance and innovation potential of his work in spectral point-of-care technologies, with applications in advanced diagnostics and healthcare.

Our spin-offs were also distinguished on the national and international stage:

- EARTO Innovation Awards (Expected Impact category) – INESC TEC's spin-off KEPsoft secured third place at the European EARTO Innovation Awards in the "Expected Impact" category, recognising its strong societal impact in improving kidney transplant matching and efficiency across national and international exchange programmes. This distinction also marks the third consecutive year in which INESC TEC has reached the podium of these European Innovation Awards, reinforcing its sustained impact and visibility at European level.
- EIT Innovation Award (Raw Materials category) – INESC TEC spin-off ProSpec, under development in 2025, was distinguished as a winner at the EIT Innovation Awards, securing first place in the Raw Materials category among 42 finalist teams from 17 countries. Recognised for its automation systems combining spectral sensors and proprietary analysis software for real-time material characterisation, the award highlights the strong commercial potential of an emerging technology developed within the institute.

Furthermore, several INESC TEC researchers and projects received other awards, prizes and recognitions for their research work or scientific contributions in international conferences and challenges. Some of them are presented in more detail in Chapter 8, contextualised in the activity of their respective R&D Centres.

3.3 Strategic Plan 2023-2030 – Progress Overview

From Strategy to Implementation

The Strategic Plan 2023–2030 establishes INESC TEC's long-term direction, reinforcing its role as a leading research and innovation institution operating at the interface between academia, industry, and society.

Built upon the Institute's mission to generate knowledge and translate it into societal and economic value, the Plan reflects a collective effort involving the INESC TEC community and external stakeholders, defining a shared vision for impactful science, technology and innovation towards 2030.

The Plan is structured around a set of five strategic commitments that guide the Institute's activities across research, innovation, talent development and societal engagement. Since its approval in 2023, these commitments have been progressively embedded in INESC TEC's operations and reflected in the results achieved.

This section provides a synthetic overview of progress in the implementation of the Strategic Plan, combining:

- Key figures reflecting cumulative evolution (2023–2025)
- Selected highlights and examples from 2025

It is not intended to be exhaustive, but rather to illustrate the most relevant developments and achievements aligned with the Institute's strategic priorities.

Strategic Commitments in Action

C1. Excel and innovate across the missions of academia, harnessing the collective strength of our community

Snapshot of Progress | Selected Key Figures (2023–2025)

On track · At risk · Off track

No. of publications per PhD in journals and conferences	No. of first priority patent applications	No. of students involved in R&D projects
4%	51%	6pp
Annual growth rate	Annual growth rate	Annual growth rate
TARGET: +3%/year	TARGET: Double in 5 years	TARGET: +1pp/year
REF. VALUE: 3%	REF. VALUE: 15%	REF. VALUE: 3pp

Progress Overview

While progress under this commitment is already visible across several dimensions, the consolidation of a structured set of indicators is still ongoing. In particular, some metrics require further internal alignment, including the definition of consistent criteria, for example regarding what constitutes a "leading venue" under the Strategic Plan. Work is currently underway to ensure robust, comparable and institution-wide measurement.

Nevertheless, INESC TEC's publication output showed a recovery and subsequent stabilisation, with conference publications rebounding in 2023 and peaking in 2024, while journal publications remained consistently strong. By 2025, both converged at similar levels (468 journal articles and 464 conference papers), reflecting a more balanced and mature output profile. This period was also marked by improved

presence in top-tier venues, including sustained contributions to CORE A* conferences and a significant increase in CORE A publications, alongside continued growth in first-quartile journal outputs.

Efforts were also made to improve the base conditions for technology commercialisation and to strengthen the articulation between research and innovation activities. This included reinforcing internal support structures dedicated to funding, intellectual property and innovation, as well as promoting closer interaction between research teams and these services. At the same time, initiatives were developed to deepen relationships with innovation partners and the broader community, including the structuring of engagement mechanisms with external stakeholders and the reinforcement of collaborative practices across the Institute. Technology transfer activities showed sustained growth over the period, supported by a robust pipeline of research results and intellectual property generation.

Furthermore, in this period, INESC TEC implemented a set of targeted initiatives to strengthen excellence across its academic missions, with a particular focus on organisational alignment, talent development and knowledge valorisation. A central development in this period was the review of the Institute's scientific organisation model, including the definition and operationalisation of Scientific Domains, aimed at improving strategic coordination and fostering stronger integration across the organisation.

In parallel, INESC TEC reinforced its contribution to advanced education and talent development through closer collaboration with Higher Education Institutions. This included the consolidation and expansion of partnerships through specific protocols with UTAD, the University of Madeira and the University of Minho.

A key step in structuring student engagement was the progressive development of dedicated initiatives that culminated in the creation of the Research Students Office in 2025, providing a centralised interface to support PhD students, internships and advanced training pathways, and improving the coordination of student-related processes across the organisation, and growingly involve them in R&D activities and projects. This enabled INESC TEC to maintain a strong and consistent role in advanced education, contributing to more than 20 PhD programmes throughout the period. In 2025, the Institute engaged over 390 PhD students and 570 Master's students, building on an already significant and well-established student base in 2023 and 2024. This sustained scale of engagement reinforces its role in attracting, training and integrating talent within the research ecosystem.

Selected highlights 2023-2025

- Recognition of scientific excellence through the FCT evaluation process - Over the three-year period, INESC TEC successfully prepared, executed and concluded the 2023/2024 FCT R&D Unit Evaluation. Following extensive institutional coordination and alignment efforts in 2023 and 2024, the Institute was awarded the highest classification of "Excellent" in 2025, confirming the quality, consistency and impact of its scientific activities at national level.
- Strengthening of the scientific organisation model and institutional alignment – During this period, the institute consolidated its renewed scientific organisation model through the implementation and maturation of Scientific Domains, strengthening their integration with R&D Centres and TEC4 initiatives. The groundwork, including preparation for the FCT evaluation and engagement of Scientific Domain Steering Committees and the Scientific Advisory Board, contributed to a more coherent and strategically aligned scientific structure across the Institute.
- Strong positioning in technology transfer and intellectual property generation - Building on a consistent presence among the national top 10 organisations in the European Patent Office (EPO) index since 2017, INESC TEC reached a new milestone in 2025 by entering the top three Portuguese organisations. This result was supported by record patenting activity, with a total record of 56 active patent families, reinforcing the Institute's leading position in national innovation performance.
- IEEE Fellow elevation – In 2025, Ricardo Bessa was elevated to IEEE Fellow, one of the highest global distinctions in engineering, in recognition of his pioneering contributions to renewable energy forecasting and decision-support systems. He joined INESC TEC researchers João Abel

Peças Lopes, João Gama and Vladimiro Miranda, further reinforcing the Institute's international recognition in this field.

- Reinforcement of academic capacity through FCT-Tenure and strategic recruitment - The launch in 2024 and implementation of the FCT-Tenure initiative in 2025 strengthened academic capacity and long-term alignment with Higher Education Institutions. The recruitment of 22 professorships, co-funded by INESC TEC and articulated with 14 permanent researcher positions, reinforced key strategic domains such as Artificial Intelligence, Quantum Computing, Bioengineering, Robotics and Energy Systems, enhancing critical mass and institutional integration.

C2. Make an impact on the toughest challenges of our time in science, technology, and society, through bold creativity and transformative action

Snapshot of Progress | Selected Key Figures (2023–2025)

On track · At risk · Off track

No. of national/international projects w/ industry	No. of policy briefs	No. of projects for digitalisation of public admin.
-2%	100%	-4%
Annual growth rate	Annual growth rate	Annual growth rate
TARGET: Increase 20% by 2030	TARGET: Grow annually to 5 in 2027	TARGET: Increase 20% by 2030
REF. VALUE: 2.3%	REF. VALUE: 71%	REF. VALUE: 2.3%

Progress Overview

Between 2023 and 2025, INESC TEC implemented a set of targeted initiatives to strengthen its capacity to address major societal challenges, with a particular focus on structuring a more impact-oriented approach to research and innovation.

Although the two indicators related to the number of projects show a slight decrease over the period, this does not signal a reduction in activity. On the contrary, the overall volume, scale, and complexity of projects increased significantly. This evolution was largely driven by the mobilisation of major national funding instruments, particularly under the Portuguese Recovery and Resilience Plan (PRR), which enabled the design and delivery of large-scale, mission-oriented, multi-stakeholder initiatives aligned with national priorities. These projects strengthened collaboration with both industry and public sector stakeholders, contributing to a more integrated and impact-driven portfolio. In parallel, engagement with Public Administration remained stable, while also evolving in scope. New collaborations emerged, notably in defence-related areas with the Army, illustrating a diversification into strategic domains. This trend, while positive, will continue to require careful monitoring to ensure sustained alignment and impact.

At the same time, INESC TEC reinforced its capacity to respond to industry needs and support innovation-driven growth through the development of integrative institutional initiatives. The launch of TEC4COMMUNICATIONS in 2025 is a key example of this approach, establishing a structured framework to connect research capabilities with industry and public stakeholders in the field of advanced communications. This initiative contributed to the consolidation of collaboration models and to the alignment of research agendas with emerging technological trends and sectoral priorities.

A further important development during this period was the strengthening of internal mechanisms to align R&D activities with global and European policy agendas, including the Sustainable Development Goals (SDGs). This included the development of methodologies to systematically map and monitor the project portfolio against societal challenges, as well as the definition of four cross-cutting challenges to guide

activities up to 2029. Together, these elements provide a clearer and shared strategic framework, enhancing coherence across research, innovation, and external engagement activities.

In parallel, INESC TEC reinforced its institutional capacity to engage with public policy and society. The restructuring of the Foresight and Public Policy Office in 2025 improved internal coordination and strengthened capabilities in foresight, policy support, and evidence-based contributions to decision-making processes. These efforts were complemented by a more structured approach to communication and public engagement, fostering more consistent interaction with policymakers, industry stakeholders, and the broader community. This is also reflected in the increased production of position papers on key strategic topics, reinforcing the Institute's role as a relevant contributor to public debate and policy development.

Selected highlights 2023-2025

- Reinforcement of INESC TEC's role as a Technology and Innovation Centre (CTI) – Following the renewal of its recognition as a CTI in 2023, INESC TEC strengthened its role as a key interface between research, industry and public policy. Over the 2023–2025 period, this framework supported the expansion of science-based innovation activities with companies, particularly SMEs, through R&D projects, technology transfer, capacity building and access to advanced infrastructures. It also reinforced the Institute's contribution to industrial competitiveness, digital transformation and sustainable development, while supporting participation in international value chains and informing public policies aligned with national and European innovation priorities.
- Structuring of cross-cutting challenges into thematic lines guiding multidisciplinary research – Building on the Strategic Plan, INESC TEC identified four cross-cutting challenges in 2023 – Digital Models, Sustainable Transformation, Tackling the Extreme, and Trustworthy Technology – to orient its contribution to major societal and technological challenges. These were progressively structured and operationalised as thematic lines guiding activities up to 2029, providing a coherent framework to organise multidisciplinary research, foster collaboration across scientific domains, and address complex, large-scale challenges with integrated and impactful approaches.
- Development of strategic research agendas and technology roadmapping – INESC TEC advanced the co-creation of multiannual Strategic Research and Innovation Agendas and developed technology roadmaps in collaboration with industry and sectoral stakeholders. These initiatives addressed key challenges such as digital transformation, data governance and decarbonisation, including contributions to sector-wide roadmaps, namely in agro-food, providing structured pathways for long-term competitiveness and transformation.
- Reinforcement of the science-policy interface at national and European levels – INESC TEC strengthened its role in shaping public policy through active contributions to key European and national processes. This included inputs to FP10, the ERA Act, the European Innovation Act, and participation in strategic consultations and forums, as well as contributions to national science policy through bodies such as the Council of Associate Laboratories.
- Production of strategic policy outputs and evidence-based contributions – The Institute delivered a broad set of position papers, policy briefs and strategic documents, addressing areas such as research and technology infrastructures, data policy, including the Dataspaces Manifesto, and energy systems. These contributions supported evidence-based policymaking and reinforced INESC TEC's role in informing regulatory and strategic frameworks.
- Expansion of science communication and public engagement – INESC TEC strengthened its outreach through the launch and consolidation of communication formats such as INESC TEC Science & Society, INESC TECWatch, podcasts and videocasts, alongside increased media presence and international dissemination. These efforts enhanced the visibility of research and promoted informed public debate on topics such as artificial intelligence, energy and digital transformation.

- Organisation and hosting of major international conferences and events – INESC TEC reinforced its role as a convening platform for global scientific and technological communities, hosting and co-organising major international conferences between 2023 and 2025, including IAMOT 2024, MELECON 2024, ECML-PKDD 2025, OFS29, and EurOMA, as well as multiple summer schools and thematic events. These initiatives strengthened international collaboration and positioned the Institute at the centre of discussions on key societal and technological challenges.

C3. Increase our relevance by closely integrating across science and innovation, disciplines, and ecosystems

Snapshot of Progress | Key Figures (2023–2025)

On track · At risk · Off track

No. of multi-scientific domain initiatives	No. of spin-offs
-1%	39%
Annual growth rate	Annual growth rate
TARGET: Increase 30% by 2030	TARGET: Increase 20% by 2023
REF. VALUE: 3.3%	REF. VALUE: 2.3%

Progress Overview

While the indicator on multi-scientific domain initiatives shows a slight decrease, this should be interpreted in the context of the broader evolution of the Institute's project portfolio, marked by an increase in the volume, scale, and complexity of activities. At the same time, greater emphasis was placed on strengthening coordination and alignment across R&D Centres, TEC4 initiatives, and Scientific Domains, contributing to a more coherent and integrated approach to knowledge production.

A key dimension of this effort was the reinforcement of linkages between knowledge generation, development, and market uptake. In 2025, INESC TEC established the Entrepreneurship and Spin-offs Office (ESO), creating a structured framework to foster innovation and entrepreneurship within its research community. This initiative supports the development of deep-tech ventures and strengthens the Institute's ability to translate research into impactful solutions. In parallel, INESC TEC enhanced entrepreneurial pathways and reinforced connections with investors, industry partners, and international networks, contributing to a more robust and integrated innovation pipeline.

The outcomes of these efforts are reflected in the sustained creation of spin-offs and the consolidation of a strong venture pipeline. This includes key milestones such as participation in SeedSight (2023), focused on advanced solutions for the agri-food sector; the consolidation and equity participation in iLoF – Intelligent Lab on Fiber (2024), a digital health venture leveraging photonics and machine learning for drug discovery; and the creation of KEPsoft CIC (2025), developed with European partners to improve kidney transplantation systems. These developments are further supported by a growing pipeline of spin-offs in areas such as photonics, robotics, systems engineering, and artificial intelligence, as well as by strengthened proof-of-concept and commercialisation support mechanisms.

In parallel, INESC TEC reinforced its strategic positioning within national and international tech-intensive value chains and expanded its role in R&I agenda-setting. This included strengthened participation in collaborative platforms, strategic initiatives, and international organisations. By 2025, the Institute was actively engaged in more than 25 international associations, broadening its geographic reach and contributing to collaborative initiatives across diverse domains. These efforts were complemented by enhanced mechanisms for stakeholder co-creation and alignment with emerging technological priorities, supporting increased international networking, leadership, and competitiveness.

Selected highlights 2023-2025

- Approval and launch of INESCTEC.OCEAN as a multidisciplinary Centre of Excellence – Following several years of preparation and ecosystem development, INESCTEC.OCEAN was approved in 2024 under Horizon Europe Teaming and launched in 2025, marking a major step in strengthening INESC TEC's role in ocean research and engineering. Developed as a Teaming project with the mentoring of SINTEF Ocean, Norway's leading R&D institution dedicated to ocean-related challenges, acting as Advanced Partner, the initiative establishes a multidisciplinary R&I framework spanning marine systems, robotics, energy and data. It is further supported by key national partners, including Fórum Oceano, the Portuguese Blue Economy cluster, and APDL – Ports of Leixões and Viana do Castelo, alongside a broader network of academic, industrial and public stakeholders. Through a dedicated stakeholder forum and structured collaboration mechanisms, INESCTEC.OCEAN fosters integrated, knowledge-based ecosystems and reinforces INESC TEC's positioning in the blue economy and in European strategic value chains.
- Sustained growth and strong positioning in European programmes – Between 2023 and 2025, INESC TEC maintained a high and consistent level of participation in European research and innovation programmes, with European funding representing a significant share of activity (€9.9M in 2023, across 115 projects) and continuing to grow in subsequent years, reaching €11.6M in 2025, across 121 projects. In 2024, this trajectory positioned INESC TEC as the third-largest Portuguese beneficiary of Horizon Europe, reflecting its strong capacity to compete, lead and collaborate in highly competitive European ecosystems.
- Advancing integration in strategic technological value chains – INESC TEC strengthened its role in national and European ecosystems through active participation in strategic initiatives, notably the approval of POEMS – Portuguese Competence Centre in Semiconductors in 2024 under the Chips for Europe Initiative and its launch in 2025. Focused on advancing capabilities in chip design, advanced packaging and emerging microelectronics technologies, POEMS aims to position Portugal at the forefront of semiconductor innovation and production. This was complemented by continued engagement in the Chips Joint Undertaking, reinforcing integration in semiconductor and cyber-physical systems value chains and strengthening connections with industry and international partners.
- Consistent European recognition through EARTO Innovation Awards – INESC TEC achieved three consecutive podium positions in the EARTO Innovation Awards, reinforcing its sustained impact and visibility at European level. In 2023, the MyNPK solution was awarded third place, showcasing innovation in smart photonics for precision agriculture. In 2024, the iLoF technology received the Innovation Prize in the "Impact Expected" category, marking the first time a Portuguese institution achieved this distinction and highlighting advances in AI-driven personalised medicine. In 2025, the spin-off KEPsoft secured third place in the same category, recognising its societal impact in improving kidney transplant systems. Together, these distinctions reflect INESC TEC's consistent ability to translate research into high-impact, internationally recognised innovations.
- Growing visibility and influence in the European research and innovation arena – INESC TEC strengthened its positioning as a recognised actor in European R&I ecosystems through sustained engagement in policy, strategic forums and collaborative initiatives. The consolidation of the INESC Brussels HUB, from its third to fifth year of operation, played a central role in this trajectory, providing a structured interface for representation, networking and policy engagement. Through coordinated contributions to key European processes, such as FP10, AI regulation, data governance and research infrastructures, and active participation in high-level groups and consultations, INESC TEC reinforced its visibility, credibility and influence in shaping European research and innovation agendas, while supporting stronger positioning in competitive programmes and strategic initiatives.

C4. Cultivate an attractive, people-centred and talented community

Snapshot of Progress | Selected Key Figures (2023–2025)

On track At risk Off track

Proportion of foreign researchers	Proportion of women in scientific positions
12%	5%
Annual growth rate	Annual growth rate
TARGET: 1/4 by 2030	TARGET: 1/3 by 2030
REF. VALUE: 22.3%	REF. VALUE: 7.9%

Progress Overview

Cultivating an attractive, people-centred, and high-performing community has been a central priority for INESC TEC over the 2023–2025 period. Efforts focused on strengthening the Institute's capacity to attract, develop, and retain talent, while reinforcing organisational structures, improving working conditions, and ensuring alignment with ethical principles and international best practices.

The indicators related to the proportion of international researchers and women in R&D positions show positive progress over the period, reflecting sustained efforts in these critical areas. However, both remain below target, largely due to the ambitious goals set by the Institute as part of its strong commitment to gender balance, diversity, and inclusion. These results highlight both the advances achieved and the need for continued focus on these domains.

A key area of development was the progressive transformation of human resources management. Building on work consolidated in 2023, INESC TEC further structured and aligned core HR processes, including job descriptions, competencies, performance management, recruitment, onboarding, and the overall employee lifecycle. These efforts advanced throughout 2024 and culminated in 2025 with the restructuring of the Human Resources Service, the establishment of clearer functional areas, and the implementation of a new job description and competency framework, supporting a more strategic, transparent, and consistent approach to human capital management.

In parallel, the Institute reinforced its attractiveness and internationalisation through the expansion of mobility and talent development initiatives. This included the consolidation of structured programmes for visiting researchers and international exchanges, the strengthening of partnerships with leading institutions, and increased participation in international mobility schemes and funding instruments. These actions contributed to enhancing global engagement, facilitating knowledge circulation, and reinforcing the Institute's international profile.

Significant attention was also given to improving the working environment and organisational culture. INESC TEC promoted flexible working models and invested in infrastructure and tools to support hybrid collaboration. These actions were complemented by initiatives led by internal commissions focused on diversity, inclusion, and community engagement, contributing to a more supportive, inclusive, and cohesive work environment.

At the same time, the Institute strengthened its commitment to research integrity and ethical conduct. This included reinforcing internal ethics structures and promoting institutional reflection on emerging challenges, ensuring that research activities are conducted in alignment with ethical standards, independence principles, and societal expectations.

Selected highlights 2023-2025

- Sustained growth and strengthening of qualified research human capital – INESC TEC continued to consolidate its position as one of the leading R&D employers in Portugal. From an activity perspective, the Institute recorded consistent growth in its scientific workforce, with the number of researchers increasing from 495 to 576, including a rise in researchers with PhD from 363 to 401, alongside an increase in PhD students from 349 to 392, reinforcing its capacity for advanced training and knowledge creation. From an employment perspective, INESC TEC strengthened its internal R&D capacity, with the number of R&D employees increasing from 126 to 166, including a significant rise in PhD-qualified staff from 95 to 125, and reaching a share of permanent positions in R&D Employees, with or without PhD, of 58% in 2025, supporting more sustained and long-term research activity.
- Expansion of international mobility and attraction of global talent – INESC TEC reinforced its internationalisation efforts through the expansion of mobility programmes and the consolidation of the INESC TEC International Visiting Researcher Programme, which has evolved into a flagship initiative with growing global demand, surpassing 100 applications in 2025. This trajectory was already evident in 2024, with record levels of submissions and participation. The Institute also strengthened engagement in international mobility and funding schemes, including OpenInnoTrain, the ERCIM Alan Bensoussan Fellowship, and the NII International Internship Programme, alongside initiatives such as Fulbright and Erasmus+. These efforts, combined with partnerships with institutions such as the University of Texas at Austin and McGill University, reinforced inbound and outbound mobility, enhanced global collaboration, and increased the diversity and international attractiveness of the research community.
- Improvement of working environment and reinforcement of diversity, inclusion and well-being practices – INESC TEC implemented a range of initiatives to enhance working conditions and organisational culture, including the maintenance of hybrid work models, participation as the only R&D institution in the national 4-Day Week pilot (2024), and targeted investments in physical workspaces and collaboration infrastructure. These efforts were complemented by reinforced actions in diversity, inclusion and internal engagement, supported by dedicated internal commissions, contributing to a more flexible, inclusive and supportive working environment.
- Advancement of research career frameworks and progression pathways – INESC TEC has been developing its approach to research careers through a structured and progressive set of actions. In 2023, the Institute consolidated the Guidelines for INESC TEC's new Career Policy, establishing the basis for a revised career framework. In 2024, this was complemented by the introduction of a transparent and merit-based progression mechanism supporting the transition from Junior to Assistant Researcher, alongside the co-organisation of a European workshop on research careers with FCT and the European Commission. In 2025, INESC TEC continued this trajectory through active participation in European initiatives, including the Mutual Learning Exercise on Research Careers, and through its involvement in the HR4EXCELLENCE Portugal Community of Practice and the REALISE proposal. The implementation of internal career framework changes remains ongoing, with further developments expected in 2026, reflecting a continued effort to build more structured, attractive and sustainable research career pathways.
- Reinforcement of ethics frameworks and responsible research practices – The institute continued to strengthen its commitment to research ethics and integrity throughout the period. In 2024, this included initiatives promoting reflection on emerging ethical challenges, notably through the INESC TEC Talks on Ethics in Research and Defence. In 2025, the Institute further reinforced its internal ethics structures, supporting a more consistent and structured approach to ethical oversight and responsible research practices across the organisation.

C5. Strive for a sound, sustainable and effective operational model

Snapshot of Progress | Selected Key Figures (2023–2025)

On track At risk Off track

Proportion of international competitive research funding	Carbon footprint
-2%	1%
Annual growth rate	Annual growth rate
TARGET: 1/3 by 2030	TARGET: 30% reduction by 2030
REF. VALUE: -1.4%	REF. VALUE: -4.4%

Progress Overview

A central aspect of this effort was the management of a diversified funding portfolio, a longstanding institutional principle aimed at ensuring financial robustness and resilience. This approach combined participation in European, national, and industry-driven activities, supported by proactive engagement with funding opportunities and strategic partnerships.

Although international competitive research funding increased steadily over the period, its relative weight slightly decreased, as reflected in the indicator. This trend is explained by the overall expansion of activity, particularly driven by national funding instruments such as the PRR. INESC TEC maintained a strong growth trajectory, with increases of +25% in 2023, +17% in 2024, and +18% in 2025, reaching €39.7 million in total activity. This evolution reflects a well-balanced funding mix, further reinforced by multiannual instruments such as CTI and FCT funding, strengthening financial sustainability.

Regarding the carbon footprint indicator, although it is currently rated as “At risk”, the results point to a contained increase, reflecting the impact of efficiency measures implemented across INESC TEC’s facilities. Notably, emissions in the most recent year returned to levels comparable to previous years, despite an approximate 24% increase in electricity consumption, corresponding to an estimated reduction of around 65 tCO_2. This highlights the positive effects of energy efficiency actions and broader ESG-related improvements.

The implementation of the Strategic Plan 2023–2030, initiated in 2023, provided an overarching framework to guide INESC TEC’s development across governance, organisational processes, infrastructure, and operational capacity.

In parallel, the institute strengthened its governance and support structures, particularly in project management, funding support, and international engagement, while enhancing compliance and management practices. The consolidation of the Project Office in 2025, including a centralised PMO, contributed to more consistent project planning, monitoring, and oversight. Progress in digitalisation was also advanced through the adoption of digital tools and initial steps in digital transformation and Open Science.

Investment in research infrastructures and organisational capabilities continued throughout the period, notably through laboratory upgrades and participation in national and regional initiatives, improving conditions for experimentation and collaboration.

Selected highlights 2023-2025

- Expansion and modernisation of research infrastructures and facilities – INESC TEC progressively strengthened its research infrastructure base through sustained investment and strategic development initiatives. In 2023, this included the establishment of new facilities for the iiLab - Industry and Innovation Lab, a cross-centre infrastructure located at P.Porto, supporting areas such as cyber-physical systems, Internet of Things, business intelligence and decision support, advanced automation and industrial robotics, mobile robotics and internal logistics, and industrial

vision systems for quality control. In 2024, the Institute continued to invest in the upgrade and expansion of laboratories and experimental platforms, supported regional infrastructure development through technical contributions to funding applications, and enhanced the operational capacity of the Mar Profundo research vessel, including international missions and the implementation of dynamic positioning capabilities. The year also marked the launch of the public tender for the Leixões Blue Hub (HAL). In 2025, this trajectory culminated in the start of construction of HAL and participation in SUSTEMARE – Centre for Technology and Innovation in Ocean Energy and Technologies, further expanding access to strategic infrastructures. Additional developments across the period included improvements in data centre and energy infrastructure, reinforcing the Institute's capacity for experimentation, validation and collaboration in real-world and industrial environments.

- Strengthening of operational efficiency through digital transformation and integrated management systems – INESC TEC progressed in the digitalisation of its operations through the gradual adoption of integrated management systems and digital tools. In 2023, this included the expansion of the use of the Customer Relationship Management (CRM) system, supporting improved interaction and information management. In 2024, the Institute further enhanced internal services through the launch of a mobile application aimed at streamlining day-to-day interactions and access to institutional tools. This trajectory continued with the implementation of a new ERP system, supporting financial and administrative integration. In 2025, more recent developments in digital transformation and Open Science were initiated, including steps towards improved data management and the exploration of artificial intelligence applications. These efforts were accompanied by continuous improvements to IT infrastructure, including cloud services, cybersecurity and digital workplace solutions, and are expected to continue evolving in 2026, contributing to more integrated and efficient organisational processes.
- Advancement of environmental sustainability and ESG practices – INESC TEC progressively strengthened the integration of environmental, social and governance (ESG) principles across its activities, building on its longstanding commitment to sustainability. Throughout the period, efforts were made to structure ESG-related practices and improve internal alignment with sustainability objectives, including initiatives in infrastructure efficiency and responsible resource use. This trajectory led to a significant improvement in ESG reporting and transparency in 2025, marking an important step forward in consolidating practices, increasing accountability, and aligning with emerging sustainability standards and stakeholder expectations.

Looking Ahead

The implementation of the Strategic Plan 2023–2030 is progressing in a structured manner, with initial results visible across several of its strategic commitments. The period between 2023 and 2025 has been particularly important in laying the foundations for long-term impact, translating strategic priorities into concrete initiatives and strengthening institutional capabilities.

Looking ahead, 2026 will mark the midpoint of the Strategic Plan's implementation cycle, representing an important opportunity for reflection and consolidation. This milestone will be accompanied by the preparation of a mid-term review, aimed at providing a more comprehensive assessment of progress to date, including the further development and operationalisation of monitoring indicators. This process may also inform a targeted update of the Strategic Plan, ensuring its continued alignment with evolving scientific, technological and societal contexts.

In parallel, INESC TEC will continue to consolidate ongoing developments, with a focus on:

- Scaling impact in science and innovation
- Reinforcing international visibility
- Deepening collaboration with industry and society

This continued effort will be important to support the effective implementation of the Strategic Plan and to strengthen its contribution to addressing societal challenges through science, technology and innovation.

4 KEY FIGURES IN 2025

4.1 Human Resources

4.1.1 Global Indicators – Headcount as of 31 December

As of this report, the presentation of INESC TEC's Human Resources adopts a revised structure intended to provide a clearer and more representative view of the institution's research ecosystem.

This structure combines two complementary perspectives. The first, "By Activity Profile," highlights the effective composition of the research community, including researchers, PhD holders, and doctoral students. The second, "By Type of Connection," preserves the more traditional HR perspective while simplifying and clarifying the main categories of institutional affiliation.

Together, these two perspectives provide a more transparent and strategically meaningful representation of INESC TEC's human resources. In particular, they strengthen the visibility of the institute's core research capacity, simplify previous classifications, and improve consistency in the interpretation of HR data.

Accordingly, Table 4.1 presents the breakdown of Human Resources by activity profile and by type of connection with INESC TEC, as well as its evolution since 2023.

Table 4.1 - Evolution of Human Resources (Headcount)

		Type of Human Resources	2023	2024	2025	Δ 2024-25	
By Activity Profile	Research Team	Researchers	516	560	583	*23*	*4%*
		of which Researchers with PhD	*369*	*390*	*410*	*20*	*5%*
		PhD Students	372	387	407	*20*	*5%*
		Total Research Team*	**852**	**902**	**945**	***43***	***5%***
	Management, Administrative and Technical Staff		122	130	144	*14*	*11%*
By Type of Connection	Core HR	Employees	364	413	434	*21*	*5%*
		of which R&D Employees	*143*	*165*	*167*	*2*	*1%*
		of which R&D Employees with PhD	*101*	*118*	*123*	*5*	*4%*
		of which Mgmt, Admin. & Technical	*120*	*130*	*144*	*14*	*11%*
		Faculty	262	268	280	*12*	*4%*
		Grant Holders	402	454	504	*50*	*11%*
		Total Core HR	**1028**	**1135**	**1218**	***83***	***7%***
	Trainees		10	31	59	*28*	*90%*
	Visiting Researchers			11	35	*24*	*218%*
	External Students		238	224	308	*84*	*38%*
	External Researchers		249	277	264	*-13*	*-5%*
		Total HR	**1525**	**1678**	**1884**	***206***	***12%***

** The Total Research Team avoids double counting; individuals who are both researchers and PhD students are counted only once.*

Activity Plan 2025

The comparison between 2025 execution and the Activity Plan is presented using headcount, since the plan itself was defined on that basis, prior to the introduction of person-year indicators. This ensures full consistency and comparability between planned and executed figures.

Overall, HR evolution remained closely aligned with the planned trajectory. The core research team recorded growth of around 7%, close to the 8% increase foreseen in the plan, confirming the expected expansion of INESC TEC's research capacity. The main trends observed in 2025 are therefore consistent with the strategic direction defined in the Activity Plan, particularly in the reinforcement of research-related roles and continued investment in talent development.

4.1.2 Global Indicators – Person-Years in 2025

While headcount provides a useful snapshot at the team at a given moment, it does not capture the movements and variations in engagement that occur throughout the year. To provide a more accurate view of INESC TEC's effective research capacity, this section also presents person-year data.

By reflecting the cumulative level of engagement over the course of the year, person-years offer a more faithful representation of the organisation's actual capacity in 2025. Table 4.2 therefore complements the headcount view with the evolution of Human Resources in person-years since 2023.

Table 4.2 - Evolution of Human Resources (Person-years)

	Type of Human Resources		2023	2024	2025	Δ 2024-25	
By Activity Profile	Research Team	Researchers	494.8	538.7	576.2	*38*	*7%*
		of which Researchers with PhD	*363.1*	*379.2*	*400.5*	*21*	*6%*
		PhD Students	348.9	387.6	392.4	5	1%
		Total Research Team*	**815.4**	**885.4**	**929.6**	***44***	***5%***
	Management, Administrative and Technical Staff		112.1	124.4	135.3	*11*	*9%*
By Type of Connection	Core HR	Employees	333.2	385.0	426.3	*41*	*11%*
		of which R&D Employees	*125.8*	*154.6*	*166.4*	*12*	*8%*
		of which R&D Employees with PhD	*95.3*	*106.0*	*124.6*	*19*	*18%*
		of which Mgmt, Admin. & Technical	*112.1*	*124.4*	*135.3*	*11*	*9%*
		Faculty	264.3	268.0	272.0	*4*	*1%*
		Grant Holders	379.9	439.3	500.3	*61*	*14%*
		Total Core HR	**977.4**	**1092.2**	**1198.5**	***106***	***10%***
	Trainees		63.3	77.7	118.7	*41*	*53%*
	Visiting Researchers			11.1	20.0	*9*	*80%*
	External Students		232.5	244.0	274.7	*31*	*13%*
	External Researchers		241.6	256.5	255.1	*-1*	*-1%*
		Total HR	**1514.8**	**1681.5**	**1866.9**	***185***	***11%***

** The Total Research Team avoids double counting; individuals who are both researchers and PhD students are counted only once.*

The comparison between headcount and person-years shows that INESC TEC's 2025 growth was not only numerical, but also qualitative. While headcount captures the breadth of the community at year-end, person-years provide a clearer picture of effective annual capacity. In particular, they reveal a much stronger reinforcement of the core employed research base, especially among PhD-level R&D staff, while also showing the inherently dynamic nature of categories such as trainees, visiting researchers and external students.

4.1.3 Global Indicators – Team Profile and Composition

Beyond overall capacity, it is also important to understand how the INESC TEC team is composed. This section therefore looks at key demographic and organisational features, including gender distribution, age profile, and internationalisation.

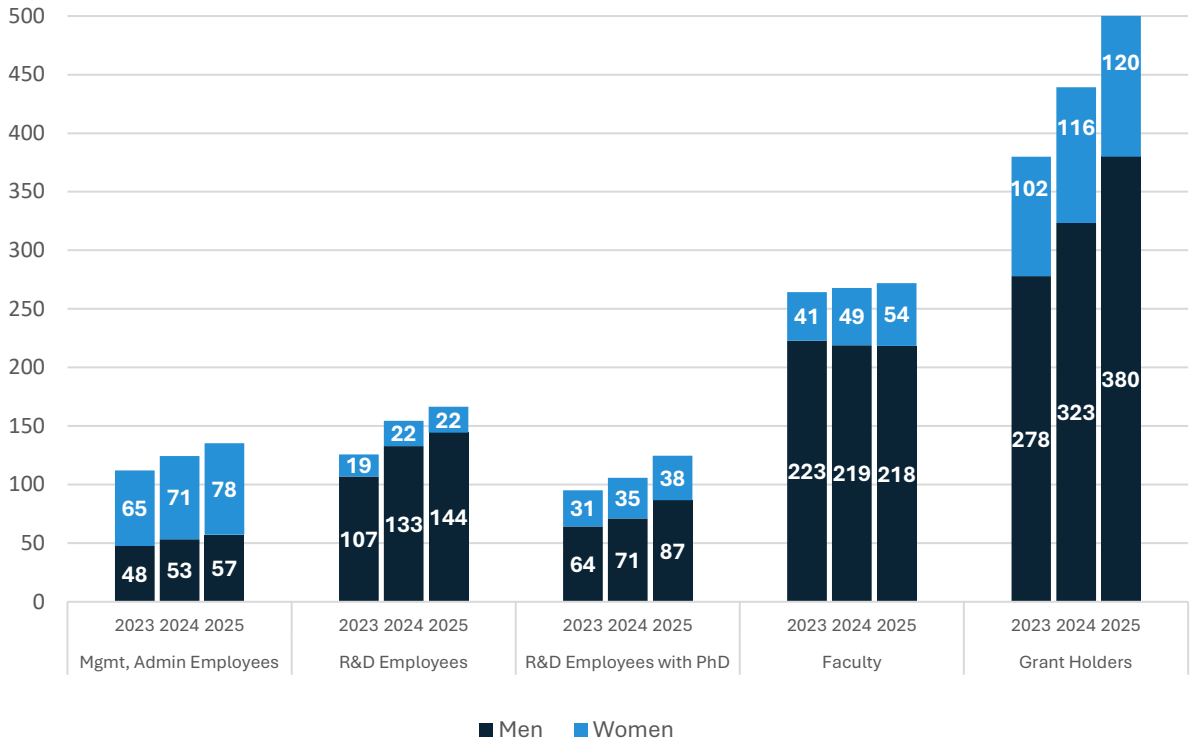


Figure 4.1 - Evolution of Human Resources (Person-Year)

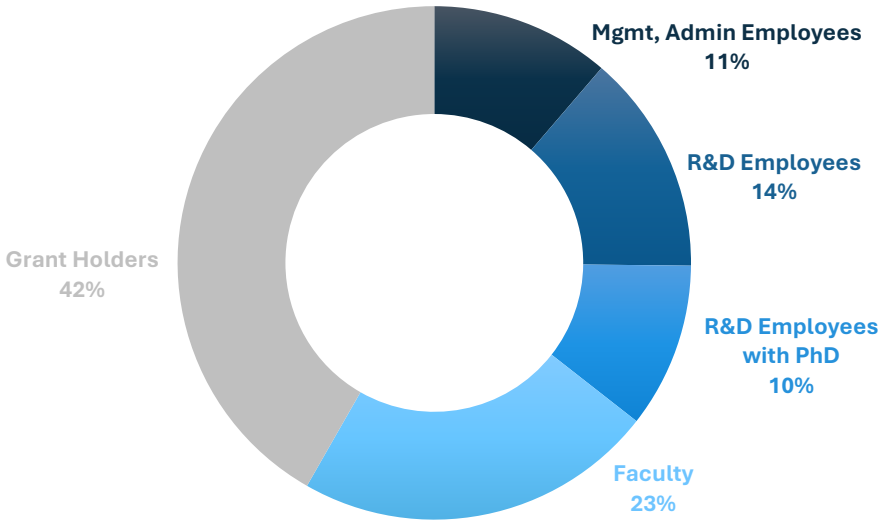


Figure 4.2 - Distribution of Human Resources (2025 Person-Year distribution)

The continued increase in R&D personnel reflects INESC TEC's expanding activity and reinforces its capacity to deliver on national and European research agendas.

As illustrated in Figure 4.2, the structure of human resources remains strongly oriented towards research-related roles, with grant holders representing the largest group (42%).

The most significant changes are observed in the sharp increase in trainees (+53%) and visiting researchers (+80%), reflecting a strong investment in talent attraction and internationalisation. This growth is closely linked to initiatives such as the Summer Internship Programme, which reached a record number of internships.

At the same time, the increase in R&D employees with a PhD (+18%) highlights the strategic reinforcement of the research team, supported by targeted recruitment in key scientific areas and initiatives such as the FCT Tenure Programme for promising researchers.

Overall, these developments reflect a sustained strengthening of INESC TEC's research workforce, both in scale and in qualification levels.

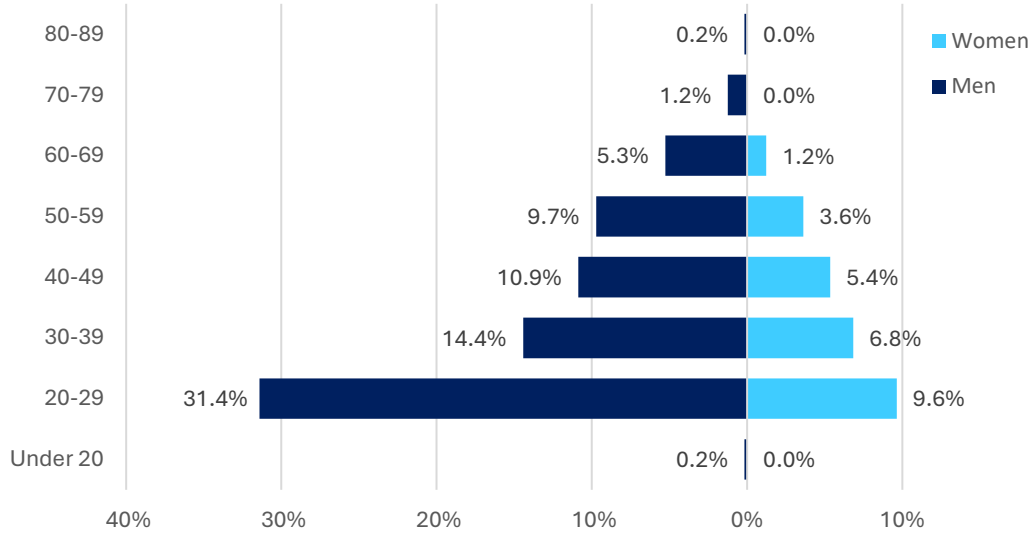


Figure 4.3 - Age distribution of INESC TEC Integrated HR by Gender

26% Women
> 40 Nationalities
> 140 Foreign Researchers

With continued attention to Diversity and Inclusion (D&I), INESC TEC monitors key indicators related to gender balance, demographic composition, and internationalisation. The age and gender distribution of human resources reflects a predominantly young workforce, with the highest concentration in the 20–29 age group, highlighting a strong presence of early-career professionals and grant holders.

Gender distribution remains uneven across all age groups. The imbalance is particularly evident in the 20–29 age group, where men represent a significantly larger share of total staff compared to women. While female representation improved slightly in the 30–49 age range, men continued to be in the majority, with disparities becoming more pronounced in older age groups. Despite ongoing efforts, the overall proportion of women in the institution remained relatively stable, indicating the structural nature of this challenge and the need for sustained, long-term action.

In parallel, INESC TEC strengthened its international profile as a result of targeted efforts in this domain. This was reflected in a 5% increase in the number of nationalities represented and a 16% growth in the number of foreign researchers, reinforcing the institution's attractiveness in the global research landscape and contributing to a more diverse and dynamic working environment.

These dimensions continued to be addressed through the work of the Diversity and Inclusion Commission and the implementation of the Gender Equality Plan (see Section 10). Overall, the data highlights the importance of maintaining a consistent focus on gender balance and inclusiveness, particularly in supporting career progression and retention across different stages of the professional lifecycle.

The 2025 data confirm the continued strengthening of INESC TEC's research workforce, both in scale and in qualification. It also highlights a predominantly young workforce, a growing international profile, and persistent gender imbalances across most age groups. These indicators remain important for understanding the institute's demographic structure, inclusiveness, and long-term sustainability as a research organisation.

4.1.4 Global Indicators – Team Mobility and Dynamics

Static indicators help characterise the structure of the team, but mobility patterns provide an additional perspective on organisational dynamics. Entries, exits and turnover rates offer useful insight into the balance between continuity and renewal across different categories of Human Resources. Figure 4.4 explores these mobility patterns in greater detail.

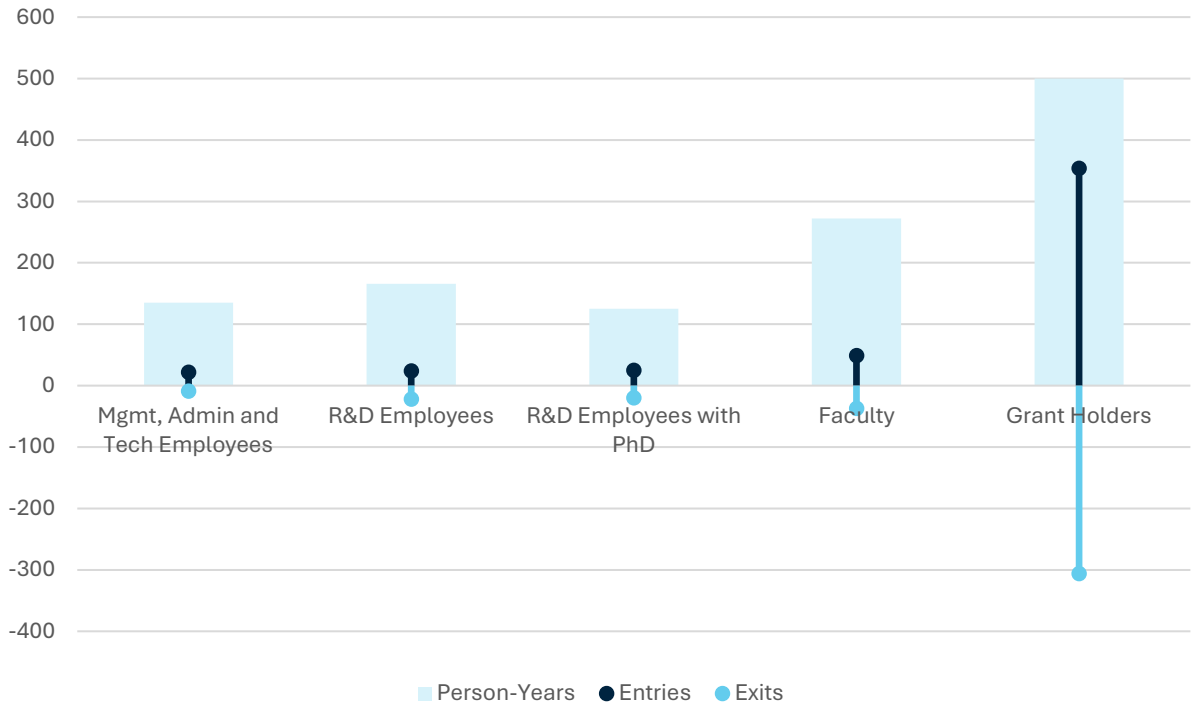


Figure 4.4 - Mobility Patterns by Types of Connection

Turnover

Mgmt, Admin and Tech Employees: 6.5%
R&D Employees: 13.3%
R&D Employees with PhD: 16.6%
Faculty: 13.5%
Grant Holders: 63.9%

Figure 4.4 illustrates the distribution of person-years, entries, and exits across various roles within the INESC TEC community, highlighting distinct patterns of personnel mobility.

Turnover rates in 2025 reflect the distinct nature of INESC TEC's human resources structure. More stable staff categories, such as Management, Administrative and Technical Employees (6.5%), show relatively low turnover, indicating organisational continuity in support functions.

Among research-related staff, turnover is higher but remains within expected ranges. R&D employees (13.3%), R&D employees with a PhD (16.6%), and faculty (13.5%) present moderate turnover levels, reflecting normal career mobility in a research-intensive environment, including progression between roles, transitions to other institutions, or changes in project involvement.

As expected, grant holders exhibit a significantly higher turnover rate (63.9%), which is largely explained by their status as students and early-stage researchers engaged in fixed-term activities. This turnover is therefore closely linked to the natural completion of study cycles and research grants, rather than indicating workforce instability.

In 2025, turnover patterns remained broadly consistent with INESC TEC's operational model: relatively low in more stable support functions, moderate among research-related staff, and significantly higher among grant holders, reflecting the temporary and training-oriented nature of many of these positions. Overall, these patterns are compatible with a model that combines a stable institutional core with a dynamic component associated with academic progression and talent circulation.

4.1.5 Global Indicators – Contract Types of R&D Employees by Gender

The distribution of contract types among R&D Employees and R&D Employees with a PhD provides an additional view of the structure and stability of the research workforce.

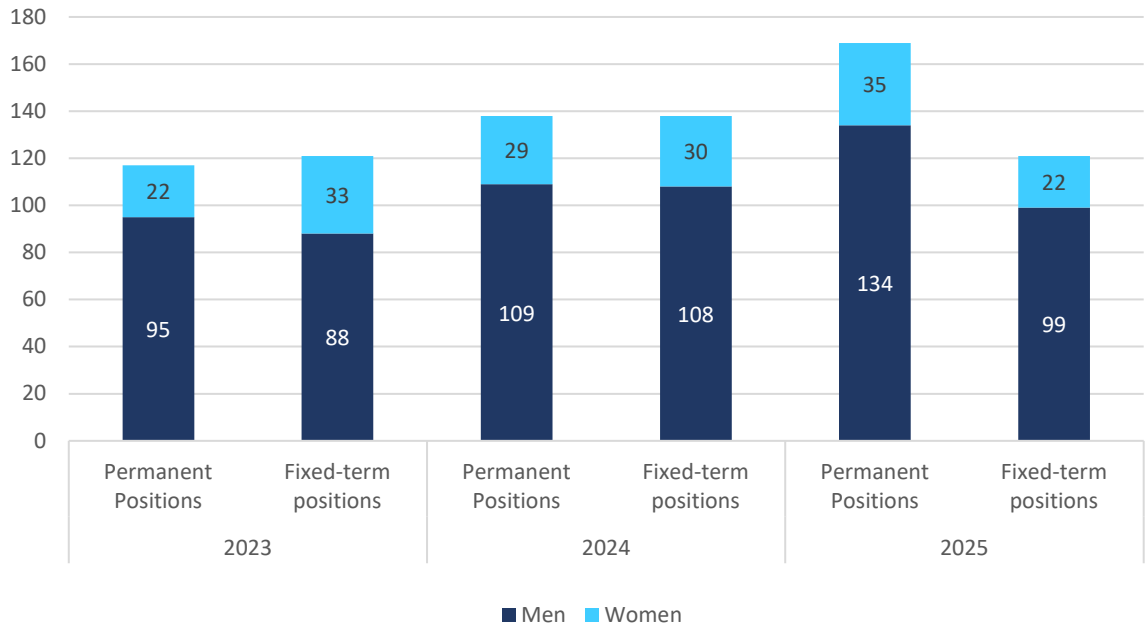


Figure 4.5 - Contract Types of R&D Employees by Gender

Figure 4.5 shows the distribution of R&D Employees and R&D Employees with a PhD at INESC TEC from 2023 to 2025, distinguishing between permanent and fixed-term positions and highlighting gender representation.

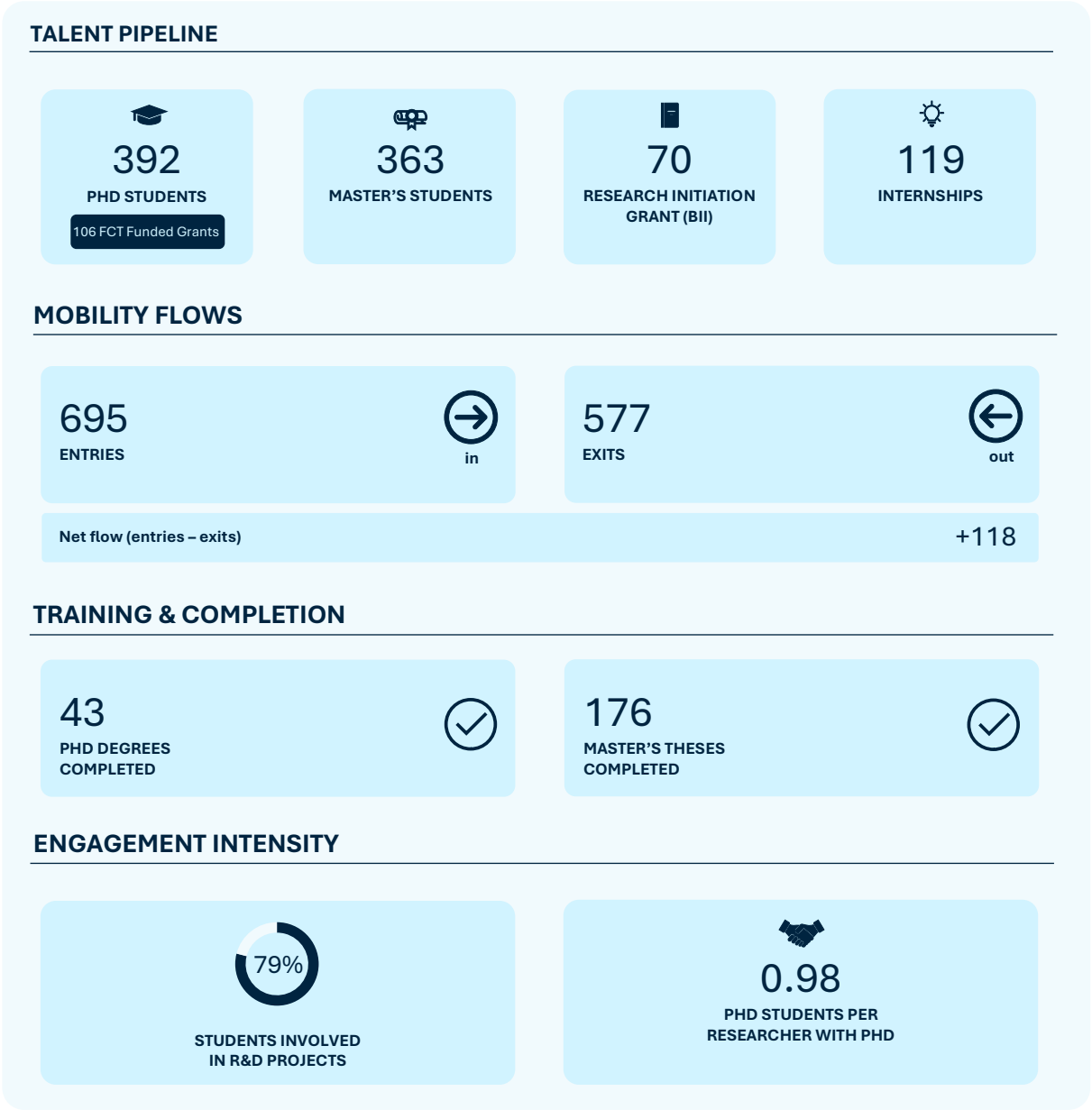
The data reveals a consistent predominance of permanent positions over fixed-term contracts across the period. This trend becomes more pronounced in 2025, with a notable increase in permanent positions, indicating a strengthening of employment stability within the research workforce. In parallel, fixed-term positions show a slight decrease, suggesting a shift towards more sustained contractual arrangements, particularly for highly qualified personnel.

From a gender perspective, men remain the majority across all categories and years. Nevertheless, female representation is present in both permanent and fixed-term positions, with a gradual increase in permanent roles over time, indicating a positive, albeit moderate, evolution in gender balance among highly qualified research staff.

The 2025 data points to a reinforcement of permanent positions, alongside a slight reduction in fixed-term contracts, suggesting a gradual strengthening of employment stability among highly qualified research staff. From a gender perspective, men remain the majority across all categories, although female representation in permanent roles shows a modest positive evolution over time.

4.1.6 Students and Talent Development

Students are a key component of INESC TEC's research ecosystem, contributing to scientific production, technology development, and knowledge transfer. The indicators below reflect the scale, engagement, and outcomes of student involvement in 2025.



Beyond the quantitative indicators, student involvement at INESC TEC is also reflected in the recognition received for the excellence, relevance, and impact of their work. In 2025, several students and teams supervised at the institute received awards and distinctions at national and international level:

- Ana Catarina Gomes, who received the IEEE Portugal Outstanding Master Thesis Award for her work on security vulnerabilities in distributed machine learning systems.
- Luís Rodrigues, who received the Vestas Award for Best Master's Thesis for his work in monetisation strategies for collaborative forecasting using blockchain.
- The Quantum SHEmulation team, composed of Alexandra Ramôa, Ana Neri and Bruna Salgado, INESC TEC researchers, and Sara Franco, INL researcher, secured second place at PQHack 2025.
- Ricardo Ferreira, who received the Best Student Paper Award at the 25th International Conference on BioInformatics and BioEngineering (BIBE 2025) for his work on algorithm supporting surgical planning.
- Pedro Afonso Dias, who received the Best Master's Thesis Award, during the 25th edition of the IEEE International Conference on Autonomous Robot Systems and Competitions (ICARSC2025), for his work Path Planning for a robotic manipulator in constrained workspaces.

The indicators presented in this section refer to students directly linked with INESC TEC. Additional student activities supervised by INESC TEC researchers in associated institutions are reported in the "Relatório de Cooperação Associados 2025", reflecting the institute's broader contribution to advanced training and supervision.

4.1.7 R&D Centres Indicators

The distribution of Human Resources across R&D Centres is presented in Table 4.3 providing a more detailed view of the institution's research capacity by organisational unit.

Table 4.3 - Human Resources by type and R&D Centre (2025 Person-year distribution)

		Total R&D Centres	R&D Centres														
			CTM	CAP	CRAS	CBER	CPES	CESE	CRIIS	CEGI	CITE	HUMANISE	LIAAD	CRACS	HASLAB	OCEAN	Special Projects
Core HR	Employees	**308.6**	13.6	17.4	40.3	10.8	84.3	31.4	33.3	11.7	6.7	24.5	16.0	1.2	17.5		
	R&D Employees	**166.7**	4.1	2.3	21.8	5.3	59.9	18.6	15.9	3.7	3.7	15.0	6.6	1.0	7.1	1.8	
	R&D Employees with PhD	**117.0**	8.5	13.0	12.5	4.5	21.4	10.8	14.1	7.0	3.0	7.8	8.4	0.2	5.8		
	Mgmt, Admin. & Technical	**29.5**	1.0	2.0	6.0	1.0	3.0	2.0	3.3	1.0		1.7	1.0		4.6	3.0	
	Faculty	**263.4**	23.3	8.1	11.6	6.9	12.1	15.3	17.3	28.3	4.4	58.2	31.1	16.8	29.9		
	Grant Holders	**500.1**	84.8	20.0	44.7	23.1	84.3	20.6	44.6	36.5	3.4	53.2	21.8	12.1	50.7	0.3	
	Total Core HR	**1072.1**	***121.7***	***45.4***	***96.7***	***40.8***	***180.7***	***67.3***	***95.1***	***76.5***	***14.5***	***135.8***	***69.0***	***30.1***	***98.1***	***0.3***	
Trainees		**115.4**	21.3	3.1	6.4	9.3	9.6	23.5	18.0	2.2		19.2	2.2		0.5		
Visiting Researchers		**19.9**	1.0		0.8	1.3	6.9		2.3	0.4		2.0	2.7	0.2	1.8		0.5
External Students		**274.2**	49.1	8.8	4.8	21.5	4.6	9.2	17.8	9.5	5.8	61.4	44.5	4.3	32.9		
External Researchers		**231.2**	28.7	4.7	6.4	14.2	18.9	15.7	13.2	24.1	10.4	38.8	23.8	6.5	24.8		1.0
	Total HR	**1712.8**	**221.8**	**62.0**	**114.9**	**87.0**	**220.8**	**115.6**	**146.6**	**112.7**	**30.8**	**257.3**	**142.3**	**41.1**	**158.1**	**0.3**	**1.5**

R&D Centres:

CTM	Centre for Telecommunications and Multimedia
CAP	Centre for Applied Photonics
CRAS	Centre for Robotics and Autonomous Systems
CBER	Centre for Biomedical Engineering Research
CPES	Centre for Power and Energy Systems
CESE	Centre for Enterprise Systems Engineering
CRIIS	Centre for Robotics and Intelligent Systems
CEGI	Centre for Industrial Engineering and Management
CITE	Centre for Innovation, Technology and Entrepreneurship
HUMANISE	Centre for Human-Centred Computing and Information Science
LIAAD	Laboratory of Artificial Intelligence and Decision Support
CRACS	Centre for Research in Advanced Computing Systems
HASLAB	High-Assurance Software Laboratory

4.1.8 Support Services Indicators

Table 4.4 presents the Human Resources figures for the Board of Directors, TEC4 teams and Support Services, expressed in 2025 person-years.

Table 4.4 - Human Resources by type and Service (2025 Person-year distribution)

Type of Human Resources		Total	Board of Directors	Offices & Board Advisors	TEC4	DPO	Support Services: Business Development Services				Support Services: Organisation and Management Services					Support Services: Technical Support Services			
							SAAF	SAL	SCOM	SRI	AG	AJ	CF	CG	RH	SAS	SGI	SIG	SRC
Core HR	Employees	**113.0**	7.0	12.2	7.8	2.0	2.0	4.6	10.2	4.8	3.1	4.8	10.5	13.8	8.5	4.7	7.0	7.0	3.0
	Faculty	**8.6**	4.0		4.6														
	Grant Holders	**0.2**									0.2								
	Total Core HR	**121.7**	**11.0**	**12.2**	**12.4**	**2.0**	**2.0**	**4.6**	**10.2**	**4.8**	**3.3**	**4.8**	**10.5**	**13.8**	**8.5**	**4.7**	**7.0**	**7.0**	**3.0**

Support Services:

AG	Management Support [1]
AJ	Legal Support
CF	Accounting and Finance
CG	Management Control
RH	Human Resources
SAAF	Funding Opportunities
SAL	Technology Licensing
SCOM	Communication
SRI	International Relations
SAS	System Administration
SGI	Infrastructure Management
SIG	Management Information Systems
SRC	Networks and Communications

[1] *Includes Secretarial Coordination*

4.2 Activity in Projects

4.2.1 Global Indicators

Table 4.5 presents the breakdown of funding sources and their evolution from 2021 to 2025. In 2025, total income reached €39.7M, representing an 18% increase over 2024 and extending the positive trajectory of recent years. This growth was supported by a diversified project portfolio and sustained activity across national and European funding instruments. Tables and figures in this section also show the distribution of active projects and average funding levels by source.

Table 4.5 - Funding sources and evolution

Sources			Value (k€)					Δ (k€ | %)	
			2021	2022	2023	2024	2025	2024-25	
Projects	PN-FCT	National R&D Programmes - FCT	2 295	1 522	1 428	1 370	1 602	232	17%
	PN-PICT	National R&D Programmes - S&T Integrated Projects	49	154	103	5	0	-5	-100%
	PN-COOP	National Cooperation Programmes with Industry	2 189	3 720	7 507	11 343	15 544	4 201	37%
	PUE-FP	EU Framework Programmes	5 529	7 642	9 273	9 315	10 873	1 558	17%
	PUE-DIV	EU Cooperation Programmes - Other	449	534	590	580	680	100	17%
	SERV-NAC	R&D Services and Consulting - National	3 519	3 527	2 726	2 528	2 563	35	1%
	SERV-INT	R&D Services and Consulting - International	678	326	579	446	639	193	43%
	OP	Other Funding Programmes	560	713	797	828	1 219	391	47%
		Total Projects	**15 270**	**18 137**	**23 003**	**26 415**	**33 121**	**6 706**	**25%**
National Strategic Programme - Pluriannual			2 257	3 062	2 442	2 810	2 238	-572	-20%
National Strategic Programme - RHAQ			520	507	128	0	0	0	-100%
National Strategic Programme - EEC			484	509	732	780	630	-150	-19%
National Strategic Programme - CTI			836	28	1 461	2 357	2 515	158	7%
National Strategic Programmes - Other			241	350	584	475	544	69	14%
Other Revenues			520	443	469	741	659	-82	-11%
		Total Revenues	**20 127**	**23 036**	**28 819**	**33 577**	**39 706**	**6 129**	**18%**

Figure 4.6 illustrates the evolution of project funding sources from 2021 to 2025. While the overall level of activity has grown, the relative contribution of each funding source has shown some variation, reflecting the cyclical dynamics of national and European funding programmes.

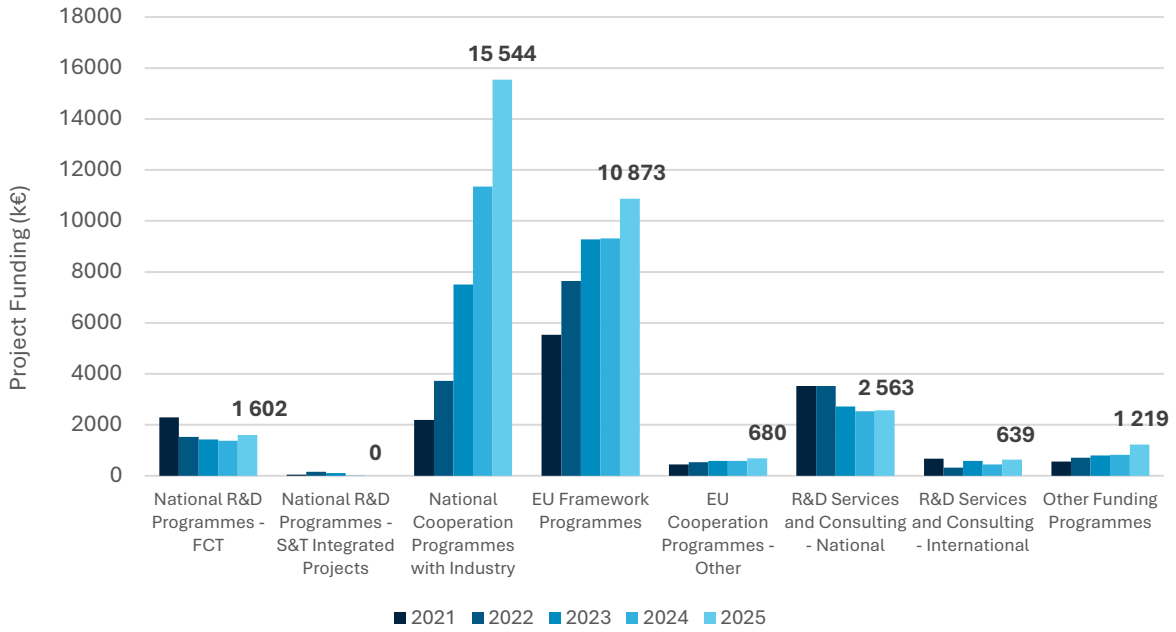


Figure 4.6 - Evolution of project funding by source (k€)

Figure 4.7 provides a snapshot comparison of the funding structure between 2024 and 2025.

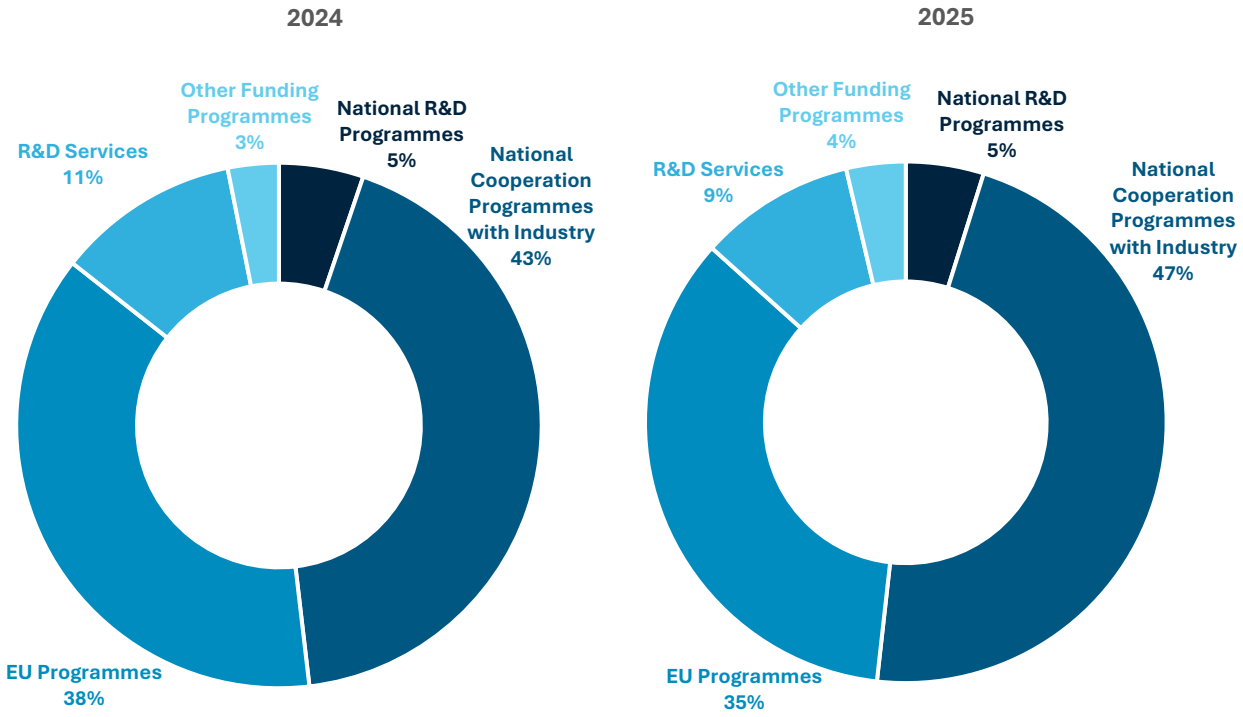


Figure 4.7 - Distribution of project funding by source – 2024 and 2025

Table 4.6 complements these indicators with the number of active projects and the average funding per project, by funding source.

Table 4.6 - Number of active projects and average funding by source

Type of Project		Number of Active Projects					Δ (%)	Average Funding (k€)	
		2021	2022	2023	2024	2025	2024-25	2024	2025
PN-FCT	National R&D Programmes - FCT	61	48	33	30	42	12	46	38
PN-PICT	National R&D Programmes - S&T Integrated Projects	1	1	1	1		-1	5	
PN-COOP	National Cooperation Programmes with Industry	46	63	71	39	46	7	291	338
PUE-FP	EU Framework Programmes	67	76	96	99	100	1	94	109
PUE-DIV	EU Cooperation Programmes - Other	15	21	19	16	21	5	36	32
SERV-NAC	R&D Services and Consulting - National	125	121	116	95	111	16	27	23
SERV-INT	R&D Services and Consulting - International	20	16	25	11	23	12	41	28
OP	Other Funding Programmes	27	18	19	15	21	6	55	58
	Total	**362**	**364**	**380**	**306**	**364**	**58**	**86**	**91**

Based on the global indicators outlined above, the following key conclusions emerge regarding INESC TEC's project activity in 2025:

Activity Plan 2025

Against the Activity Plan, 2025, revenues short of the projected €44.5M by €4, 757k (-10.7%). This deviation was mainly driven by lower-than-expected performance in National Cooperation Programmes with Industry and EU Framework Programmes partially offset by stronger-than-planned results in R&D Services and Consulting (notably national ones), as well as higher revenues in FCT Projects and Other Funding Programmes. Despite this gap, execution remained

robust and confirmed the institute's capacity to sustain growth while adapting to changing programme dynamics.

In 2025, INESC TEC managed more than 360 active R&D projects, confirming the scale and diversity of its activity. Nationally funded activity grew by 19%, largely driven by the execution of 22 collaborative projects under the PRR, which together accounted for around €15M. These mobilising agendas remained a central pillar of INESC TEC's contribution to national industrial and innovation priorities.

European programme funding also remained at a high level, reaching €11.6M across 121 projects, including 9 Horizon Europe projects coordinated by INESC TEC. This sustained performance reinforces the institute's position as the third-largest Portuguese beneficiary of Horizon Europe, after two universities, and confirms its capacity to compete and lead in demanding international R&I environments. A particularly relevant contribution came from the INESCTEC.OCEAN Teaming initiative, which secured €559k in 2025 and further strengthened the institute's strategic positioning in the European research landscape.

Income from direct R&D and consulting services increased by 34% in 2025, reflecting stronger company engagement and a recovery from earlier constraints in national funding cycles. This growth highlights the resilience of demand for INESC TEC's technological expertise and the complementary role of direct collaboration with industry alongside public funding instruments.

Although more limited in volume, Pluriannual funding and CTI base funding continued to play an important strategic role. Together, they supported core institutional capabilities and longer-term activities that extend beyond the logic of project-based funding, particularly in research continuity, technology transfer and engagement with industry.

The increase in FCT project funding, with the number of active projects rising from 30 to 42 and revenues growing from €1.4M to €1.6M, also suggests renewed momentum after the slowdown observed in 2024. At the same time, the expected conclusion of PRR funding in mid-2026 points to a significant strategic inflection point. Maintaining the current scale and diversity of activity will depend on a forward-looking approach to the post-PRR funding landscape, both nationally and at European level.

4.2.2 R&D Centres Indicators

A detailed view of the total funding by source per R&D Centre is presented in Table 4.7 and Figure 4.8.

Table 4.7 - Project Funding (k€) per R&D Centre

	Funding Source	Total (k€)	R&D Centres															
			CTM	CAP	CRAS	CBER	CPES	CESE	CRIIS	CEGI	CITE	HUMANISE	LIAAD	CRACS	HASLAB	OCEAN	Special Projects
Projects	PN-FCT	**1 602**	66	131	626	93	81	10	54	95	0	87	241	31	87	0	0
	PN-PICT	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PN-COOP	**15 544**	1 035	1 079	1 152	386	4 414	1 463	2 511	644	216	1 339	439	96	741	0	29
	PUE-FP	**10 873**	1 484	189	2 791	290	2 027	617	502	383	377	1 098	217	88	171	559	82
	PUE-DIV	**680**	5	4	302	0	11	2	30	0	57	43	0	28	173	0	26
	SERV-NAC	**2 563**	54	41	335	32	668	230	136	112	0	460	160	0	263	0	72
	SERV-INT	**639**	0	8	93	67	372	13	20	0	0	5	35	0	18	0	9
	OP	**1 219**	30	418	84	12	4	51	0	0	0	0	160	1	155	25	280
	Total Funding	**33 121**	**2 674**	**1 868**	**5 382**	**879**	**7 577**	**2 387**	**3 253**	**1 234**	**650**	**3 031**	**1 252**	**243**	**1 608**	**584**	**499**

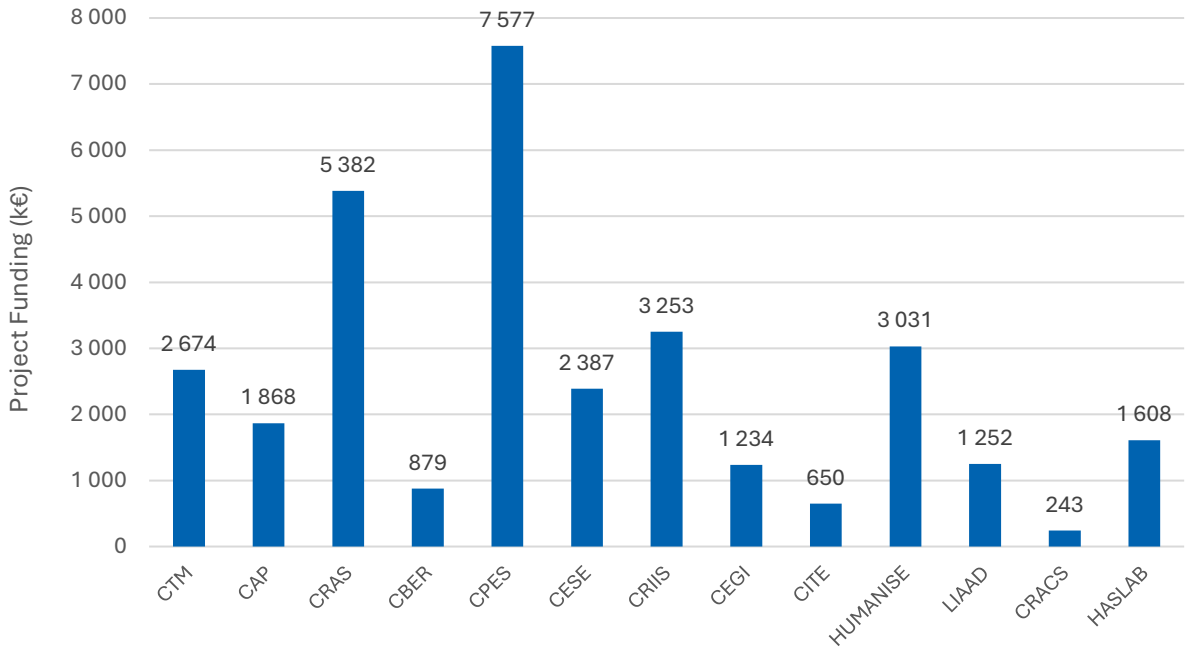


Figure 4.8 - Total Project Funding per R&D Centre (k€)

4.3 Publications

4.3.1 Global Indicators

Table 4.8 and Table 4.9 together with Figure 4.9 and Figure 4.10, present the evolution of INESC TEC's scientific publications since 2021. Two complementary data sets are shown:

- Consolidated data, calculated three months after year-end, and used in the Activity Report;
- Closed data, calculated eleven months after year-end and used for institutional planning.

This two-stage approach reflects the time needed for the indexing and validation of scientific outputs. Publication data is sourced from multiple indexing systems (ISI, Scopus, and CORE via the Authenticus platform), and publications involving multiple Centres are counted once per Centre, with the institutional total adjusted to avoid duplication.

Table 4.8 - Number of publications by type (consolidated data, 2021–2025)

Publication Type	2021 (Consolidated)	2022 (Consolidated)	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	440	465	489	461	468
Indexed Conferences	362	349	427	482	464
Books	3	3	7	3	7
Book Chapters	34	45	31	21	42
Completed PhD Theses – Members	30	31	25	45	43
Completed PhD Theses – Supervised	58	43	38	74	64

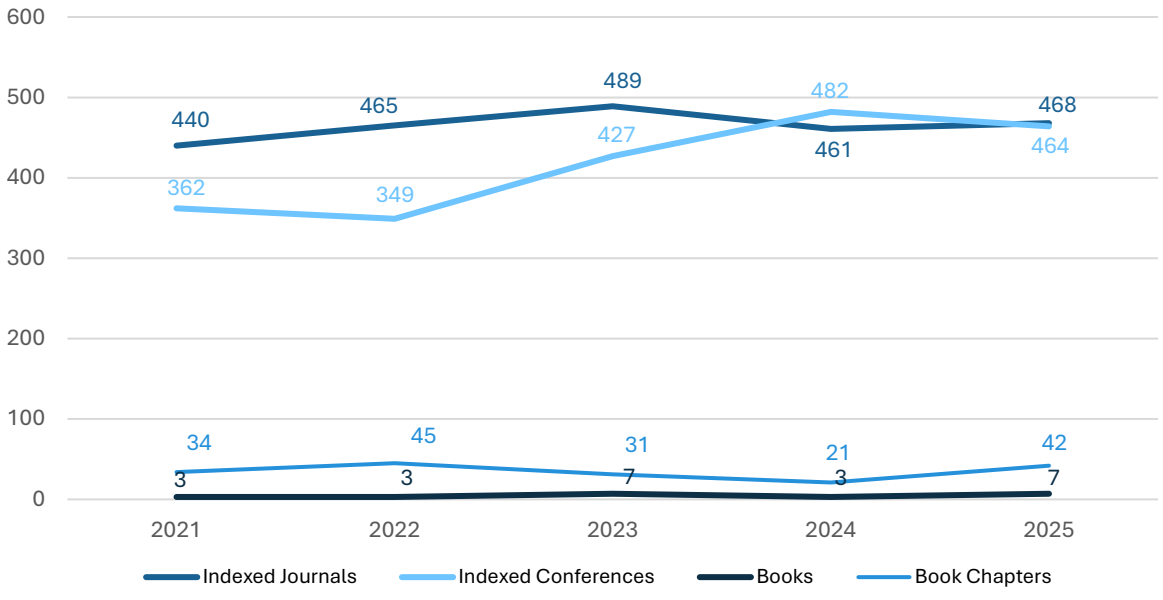


Figure 4.9 - Evolution of publications by type (consolidated data, 2021–2025)

Table 4.9 - Number of publications by type (closed data, 2021–2024)

Publication Type	2021 (Closed)	2022 (Closed)	2023 (Closed)	2024 (Closed)
Indexed Journals	451	539	524	495
Indexed Conferences	471	446	538	557
Books	4	4	11	6
Book Chapters	33	40	31	28
Completed PhD Theses – Members	30	31	25	45
Completed PhD Theses – Supervised	58	43	38	74

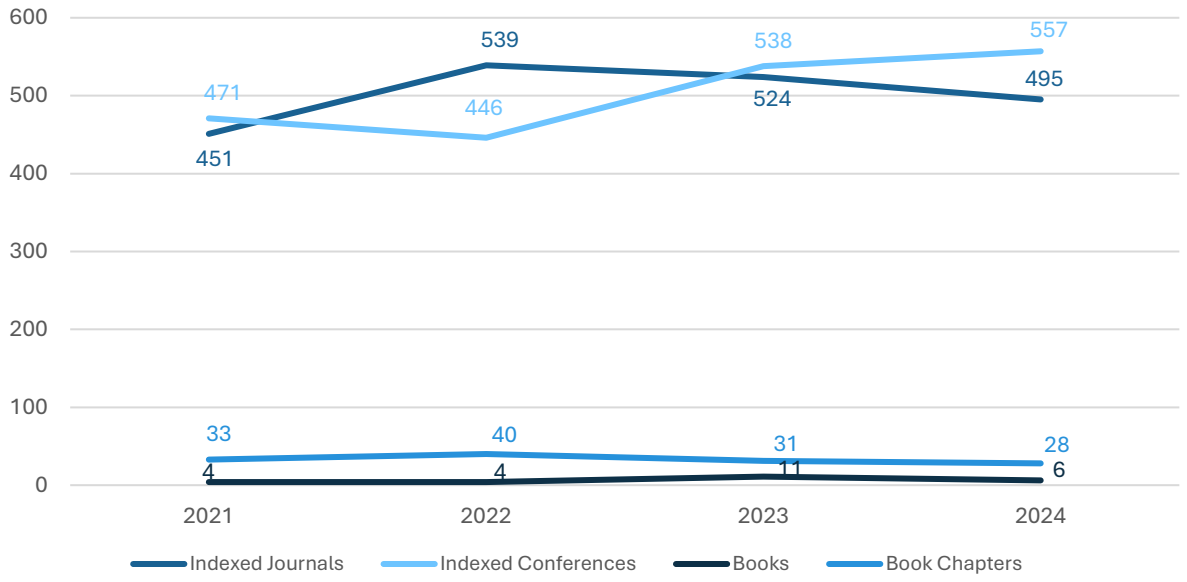


Figure 4.10 - Evolution of publications by type (closed data, 2021–2024)

Activity Plan 2025

INESC TEC's 2025 performance in indexed publications exceeded the targets set in the Annual Plan, which had projected 394 journal articles and 373 conference papers.

In 2025, indexed journal and conference publications reached very similar levels, with 468 journal articles and 464 conference papers, reflecting a stabilisation of outputs after the fluctuations observed in previous years. Journal publications showed a slight recovery compared to 2024, while conference publications declined from their 2024 peak but remained at historically high levels. In addition, 11 papers were presented at CORE A* conferences, and the number of articles in CORE A conferences increased from 14 to 23.

PhD thesis completions remained at a solid level in 2025, with 43 theses by members and 64 supervised, staying above the levels observed in most previous years despite being below the 2024 peak.

This performance should also be considered in the context of a year marked by a strong focus on the execution of large-scale projects, particularly under the PRR, which may have influenced the balance

between project delivery and academic output. Nonetheless, reinforcing scientific production remains a key priority going forward.

This trend is also reflected in the publication intensity per Researcher with PhD (Figure 4.11), where both journal and conference outputs per researcher show a slight decline compared to 2024 and converge in 2025.

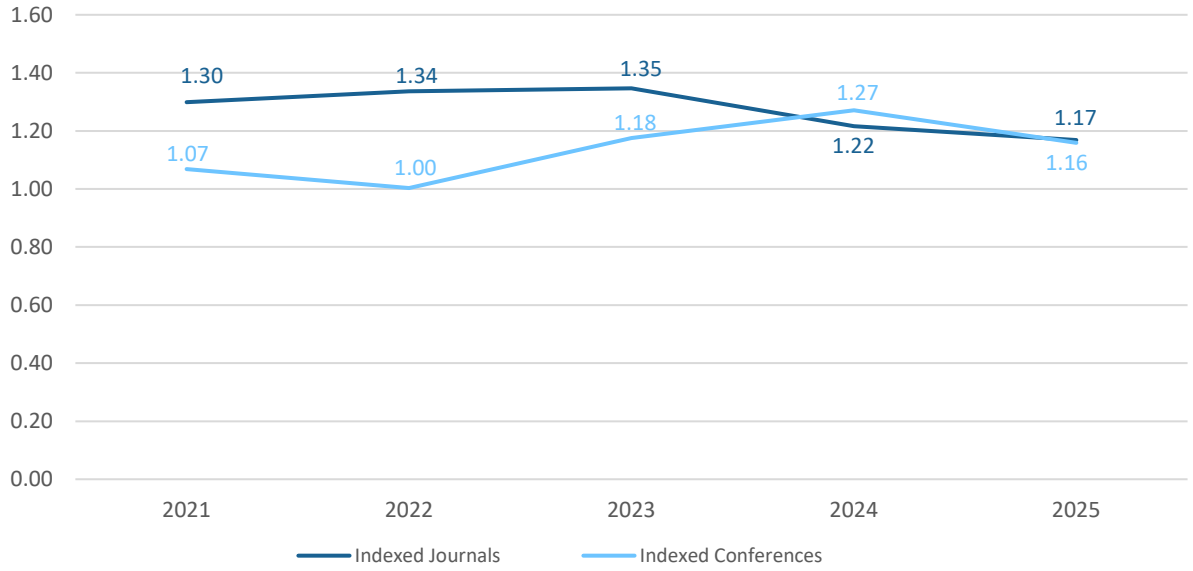


Figure 4.11 - Indexed publications per Researcher with PhD (consolidated data, 2021-2025)

Beyond publication intensity, quality indicators continued to show a strong profile. In Scopus-indexed journal publications, 69% of articles in 2025 were published in first-quartile (Q1) journals (324 out of 468), representing a slight decrease from 332 in 2024 (Figure 4.12), while the combined proportion of Q1 and Q2 journals reached 91%, reinforcing a strong orientation toward quality and visibility.

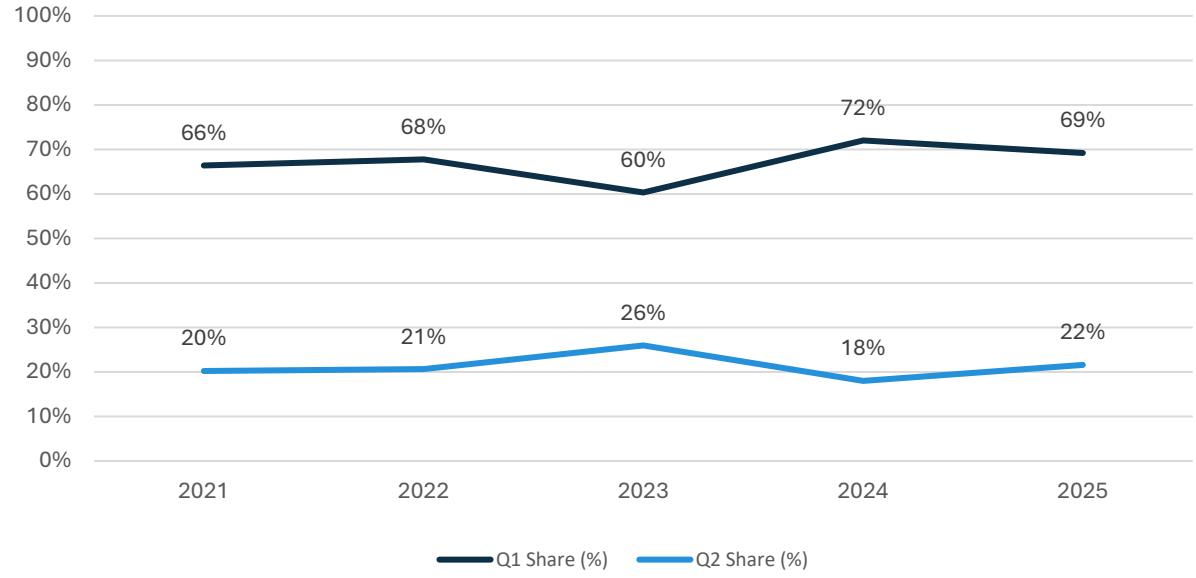


Figure 4.12 - Evolution of indexed journal articles by impact factor quartile Q1 and Q2 (Scopus, 2025)

Open Access (OA) also remained significant. Of the 961 documents indexed in Scopus as of March 2026, including journal articles, conference papers, and book chapters, 50% were available as OA (481

documents), with 26% published as Gold OA and 23% available through Green OA. Considering only journal articles (461 documents), 70% were available as OA, with 39% published as Golden OA.

International collaboration also remained a strong feature of INESC TEC's publication profile. In 2025, 33% of indexed publications involved co-authors from international institutions, rising to 41% for journal articles, well above typical global levels of international co-authorship.

R&D Centres Indicators

Figure 4.13 presents the number of indexed publications in journals and conferences per R&D Centre. A more detailed breakdown of the publication indicators is presented in Chapter 8 and Annex I.

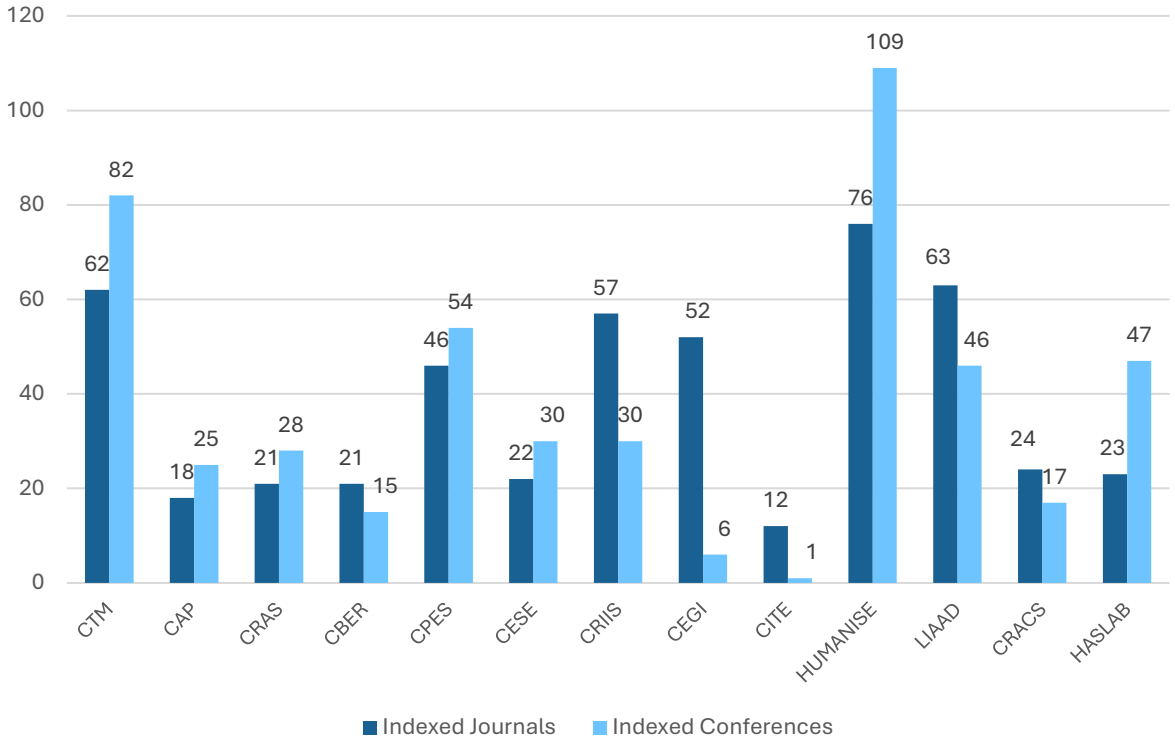


Figure 4.13 - Indexed Publications in Journals and Conferences by Centre (consolidated data, 2025)

4.3.2 Research Data Publication

The publication of research data enhances transparency, fosters collaboration, and increases the impact of scientific work. INESC TEC is committed to open data practices, ensuring its research outputs are accessible, reusable, and contribute to scientific progress.

In 2025, 14 datasets were made publicly available as traceable research outputs, further reinforcing INESC TEC´s contribution to data-driven research. These datasets are strongly oriented towards areas such as information retrieval, natural language processing, and artificial intelligence, while also covering domains including robotics, computer vision, industrial monitoring, clinical data processing and energy systems.

Many of the datasets incorporate rich annotations and are designed to support benchmarking, semantic analysis, and multilingual research, including resources for underrepresented languages such as Tetun. Several datasets address real-world challenges, such as transparency in local governance and privacy-preservation, and sustainable resource use, highlighting their relevance beyond academia. Together, they reflect a growing maturity in the production of reusable research data with clear scientific and societal relevance.

By the end of 2025, the repository housed 162 open datasets.

Table 4.10 outlines the datasets made publicly available in 2025 across the institutional repository and other recognised data repositories.

Table 4.10 - Datasets made publicly available in 2025

Dataset	Description
IILABS 3D: iilab Indoor LiDAR-based SLAM dataset CRIIS Jorge Ribeiro et al., 2025 https://doi.org/10.25747/VHNJ-WM80	The IILABS 3D dataset provides multimodal sensor data for benchmarking 3D LiDAR-based SLAM algorithms in complex indoor environments. It integrates synchronised data from multiple LiDAR sensors, IMU, and wheel odometry, along with high-precision ground truth from a Motion Capture system.
ImageCLEFmed 2013 case-based retrieval task relevance judgements expansion via an MLLM-as-a-Judge approach HumanISE Catarina Pires et al., 2025 https://doi.org/10.5281/zenodo.14866103	This dataset offers expanded relevance judgements (qrels) for the ImageCLEFmed 2013 case-based retrieval task. Generated using an MLLM-as-a-Judge approach with the Gemini 1.5 Pro model, it significantly increases the original annotations to support improved evaluation of medical retrieval systems.
Interface Element Frequencies in Search Engine Results Pages (SERPs) Across Query Intents, Search Engines and Languages HumanISE Adelaide Santos & Carla Teixeira Lopes, 2025 https://doi.org/10.25747/r7ew-wh96	A dataset of large-scale SERP data for analysing user interface variations across search engines and query types. It contains thousands of captured results pages from major search engines, along with structured annotations of interface elements and translated queries to support multilingual analysis.
High-Resolution Clothing Segmentation Dataset for Deep Learning CRIIS Daniel Lopes et al., 2025 https://doi.org/10.25747/hk3q-e576	This dataset provides annotated garment images for deep-learning-based image segmentation tasks. It includes high-resolution images of clothing items with corresponding binary masks, supporting model training, validation, and testing in both controlled and laboratory environments.
Comprehensive Multi-Domain Experiment Reproducibility Dataset HumanISE, HASLAB Lázaro Costa et al., 2025 https://doi.org/10.5281/zenodo.14093850	This dataset consists of a curated collection of 20 computational experiments for evaluating and benchmarking reproducibility tools across multiple scientific domains. It includes experiments from areas such as computer science, HCI, medicine, artificial intelligence, climate change, and economics, covering diverse computational workflows and reproducibility challenges.

Dataset	Description
Motiv: A Dataset of Latent Space Representations of Musical Phrase Motions CTM Nádia Carvalho, 2025 https://doi.org/10.7910/DVN/RWCG4B	The Motiv dataset provides audio recordings and latent space representations of musical phrases to support the analysis of musical motion. Annotated variations performed by professional musicians capture different motion types, enabling the study of their geometric relationships through latent space models.
CitiLink-Minutes: A Multilayer Annotated Dataset of Municipal Meeting Minutes LIAAD, HumanISE Ricardo Campos et al., 2025 https://doi.org/10.25747/7kg6-1k22	This dataset contains multilayer annotations of 120 municipal meeting minutes from Portuguese city councils, covering metadata, discussion subjects, and voting information. Over 31,000 annotated entities and relations support research in Information Retrieval and Natural Language Processing for local governance transparency.
Synthetic Data from Industrial Sensor Monitoring CESE Davide Carneiro et al., 2025 https://doi.org/10.5281/zenodo.15277167	A collection of five datasets simulating sensor readings from industrial production lines, including temperature, pressure, and runtime measurements under normal and anomalous conditions. The data supports research in industrial monitoring and machine learning applications.
EV Charging Sessions Dataset from INESC TEC Headquarters CPES Gil Sampaio, 2025 https://doi.org/10.5281/zenodo.15277167	This dataset provides real-world measurements of power consumption from multiple electric vehicle charging stations. It includes anonymised user identifiers and detailed charging sessions data, supporting research in energy management, smart mobility, and charging behaviour analysis.
ClaimPT: A Dataset for Claim Detection and Fact-Checking LIAAD, HumanISE Ricardo Campos et al., 2025 https://doi.org/10.25747/jy10-e413	ClaimPT is a Portuguese dataset of manually annotated claims in 1,308 news articles from the LUSA news agency. Annotations by two trained linguists cover claim spans, claimers, topics, stance, and temporal information, supporting research in claim detection and fact-checking.
LusoClin: Dataset of synthetic clinical notes in European Portuguese generated using an open-source large language model, along with prompting and evaluation data HumanISE Daniel Félix & Carla Teixeira Lopes, 2025 https://doi.org/10.25747/4gc6-dk48	LusoClin is a dataset of 54,518 fully synthetic clinical notes, supporting privacy-preserving research in clinical information retrieval. This dataset support tasks such as semantic search, document retrieval, and cohort identification in clinical data.
Labadain-ZSRunS: Sparse and Zero-Shot Dense Retrieval Runs with LLM-Generated Summaries for Tetun Ad-Hoc Text Retrieval HumanISE Gabriel de Jesus et al., 2025 https://doi.org/10.25747/rfzx-m945	Labadain-ZSRunS provides retrieval outputs from sparse and zero-shot dense models for Tetun text retrieval, along with LLM-generated document summaries, supporting research in multilingual and cross-lingual retrieval for underrepresented languages.
Labadain-Avaliadór: A Test Collection for Tetun Ad-Hoc Text Retrieval **HumanISE** **Gabriel de Jesus & Sérgio Nunes, 2025** https://doi.org/10.25747/2k6s-e518	Labadain-Avaliadór is a test collection for ad-hoc retrieval, comprising 59 topics, 33,550 documents, and 5,900 relevance judgements. Queries are derived from real-world search logs, and the document collection is based on the Labadain-30k+ dataset, supporting research in information retrieval for underrepresented languages.
Labadain- Stopwords: A Curated List of 160 Tetun Stopwords **HumanISE** **Gabriel de Jesus & Sérgio Nunes, 2025** https://doi.org/10.25747/KBZB-R124	Labadain-Stopwords is a curated list of 160 Tetun stopwords, compiled from the Labadain-30k+ dataset and validated by native speakers. It enables information retrieval and natural language processing tasks and is distributed in plain text format for easy integration.

4.4 Technology Transfer

INESC TEC's results in technology transfer activities in 2025 (Table 4.11), overall, were in line with or exceeded expectations set in the annual plan, reflecting a strong institutional commitment by the R&D Centres and proactive scouting by the Technology Licensing Office (TLO, SAL).

Table 4.11 - Results in intellectual property protection, exploitation, and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)	31	40	30
Technology Disclosures (TDF)	23	13	43
First Priority Patent Applications (New Inventions)	8	9	19
First Patents Internationalisation	5	5	7
First Patent Granted	7	1	2
Commercial Contracts (Licences, Options, Assignments)	3	5	1
Spin-offs established	1	1	1
Spin-offs in development	5	10	8

Activity Plan 2025

In 2025, Knowledge Transfer results show a mixed performance against plan, with strong outcomes in early-stage innovation and intellectual property generation, but weaker results in downstream commercialisation. Technology Disclosures (43 vs. 24 planned) and First Priority Patent Applications (19 vs. 8) significantly exceeded expectations, indicating a high level of inventive activity. Similarly, patent internationalisation also surpassed targets. However, this upstream strength did not fully translate into market outcomes, as Commercial Contracts (1 vs. 7) and Spin-offs (1 vs. 3) fell short of plan. At the same time, the high number of Spin-offs in development (8 vs. 2) suggests a solid pipeline for future valorisation. Overall, results point to a robust innovation engine, with some time lag in conversion into commercial impact.

This dynamic is evident in the detailed 2025 activity, which shows sustained intensity in IP generation and portfolio expansion, alongside a still-maturing translation into commercial and entrepreneurial outputs. The innovation pipeline remained strong, with 43 technology disclosures and 30 pre-disclosures, demonstrating continued engagement from researchers and a growing base of results with valorisation potential.

The pipeline of innovation remained strong, with 43 technology disclosures and 30 pre-disclosures recorded, demonstrating sustained engagement from researchers and a growing portfolio of results with valorisation potential.

INESC TEC managed a record 56 active patent families, including 19 first-priority applications in 2025, along with 7 internationalisation processes, reinforcing the institute's commitment to the global protection of its technologies. Two patents were granted during the year, both in the field of photonics, with one also intersecting with robotics.

In 2025, one commercial agreement in the area of bioengineering was secured, reflecting ongoing efforts to translate research results into market applications.

Spin-off development continued, with one new spin-off formally established during the year, reflecting the sustained pipeline of research translation into entrepreneurial ventures. KEPsoft Collaborative was established as a not-for-profit social enterprise spin-off company of the University of Glasgow, INESC TEC,

HUN-REN KRTK and Óbuda University. It developed a solution aimed at improving access to and efficiency in kidney transplantation, while enhancing patients' quality of life and generating potential savings of up to €2M per 100 patients for healthcare systems. The initiative was recognised at the 2025 EARTO Awards, where KEPsoft was among the winners in the Expected Impact category.

In addition, eight other spin-offs remained under development across areas such as photonics, robotics, and systems engineering, with the new Entrepreneurship and Spinoffs Office (ESO) providing structured support and guidance throughout these processes.

Technological entrepreneurship

INESC TEC actively supports the creation of spin-offs based on technologies developed internally, with a view to promoting innovation and market deployment. Table 4.12 provides an overview of recent spin-offs, highlighting key developments in 2025.

Table 4.12 - Recent INESC TEC spin-offs and 2025 developments

Name and description	Main developments in 2025
Ubirider Develop solutions to make urban mobility smarter and to improve travellers' overall experience. Pick is a universal app which integrates any mobility service for multimodal trip planning and mobile payment of fares. **Year of incorporation: 2018** **Sector: Digital mobility** **Employees (FTE): 22**	- Selected for Mastercard's Start Path Emerging Fintech program as one of only eight startups worldwide in the 2025 cohort, accelerating UbiRider's international positioning in digital payments and mobility fintech. - Achieved PCI DSS certification, reinforcing the security of its open-loop payment platform and strengthening its readiness to scale secure digital fare collection solutions internationally.
Insignals Neurotech Wearable wireless devices to precisely measure wrist rigidity, helping surgeons place brain implants more accurately during surgery on patients with Parkinson's, epilepsy, and other neural conditions. **Year of incorporation: 2019** **Sector: Medtech** **Employees (FTE): < 5**	- Advanced remote monitoring studies for Parkinson's disease and initiated the adaptation of the iHandU technology for smartwatch-based use. - Started the development of a patient-centred digital health application to support autonomous, remote use and improve communication between patients and healthcare professionals.
iLoF Leverage machine learning to drastically reduce the cost and time of drug discovery, using a patented photonics and Artificial Intelligence system to identify unique features of various gold-standard biomarkers, capturing their signature on a cloud-based library. **Year of incorporation: 2019** **Sector: Medtech, Digital health** **Employees (FTE): 30**	- Strengthened its London-based UK operations, supporting clinical and product development activities. - Expanded its oncology activities, building on iLoF's growing focus on precision medicine applications beyond neurodegeneration.
UNEXMIN Georobotics Underwater mine exploration robotic system for commercial mine surveying, exploration and geoscientific purposes. **Year of incorporation: 2021** **Sector: Geological consulting** **Employees (FTE): 6.5**	- PIPEON Horizon Europe project (https://pipeon.eu/) was initiated, focusing on the development of a sewer inspection robot docking station, battery pack with wired/wireless charging, surface communication, and Ground Penetrating Radar; development activities began in 2025. - Further development of the company's underwater robot continued in 2025, including modifications to enable operation in fully saturated salt water.
SeedSight Inc. Focus: Optical and advanced AI technologies combined with big data structures about seed and grains to mitigate food waste and fraud. **Year of incorporation: 2023** **Sector: Agro-food** **Employees (FTE): 8**	- Increase market traction through nonpaid and paid industrial pilots. - Business model maturation (first pricing model designed and a defined SaaS library offering) and Pre Seed Equity fundraising round of 1.78M€.
KEPSoft CIC Improve the efficiency, fairness, and sustainability of kidney exchange programmes through advanced optimisation software. **Year of incorporation: 2025** **Sector: Health** **Employees (FTE): 0.2**	- Software under test by the transplantation organisations of Hungary, Italy and Spain. - Medical device certification is in progress.

The institution continued to leverage its spin-off portfolio as a mechanism for knowledge valorisation, entrepreneurial learning, and societal impact. In 2025, spin-off activity spanned sectors ranging from digital mobility and fintech to medtech and agri-food, showcasing the diversity of INESC TEC's innovation pipeline.

As a final note, during the reporting period, the dissolution of the spin-off KEYRUPTIVE, in which INESC TEC held a minority stake, was completed. The decision followed an assessment of its techno-economic viability, carried out by the promoters with the support of INESC TEC, as well as a review of the strategic positioning of the associated intellectual property. As part of the closure process, the related intellectual property assets were reverted and reintegrated into the institution's IP portfolio for subsequent management and valorisation.

4.5 Dissemination Activities

INESC TEC researchers and R&D Centres maintained a strong level of engagement in scientific and technical dissemination throughout 2025, even as project activity and institutional growth continued to expand. Table 4.13 summarises the evolution of dissemination activity over the past three years.

Table 4.13 - Participation in dissemination activities (2023–2025)

Type of Activity	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	105	109	103
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	72	59	62
International events in which INESC TEC members participate in the program committees	258	222	235
Participation in events such as fairs, exhibitions or similar	92	104	123
Conferences, workshops and scientific sessions organised by the R&D Centres	66	92	88
Participants in the conferences, workshops and scientific sessions organised by the R&D Centres	3 347	5 596	8 532
Advanced training courses organised by the R&D Centres	11	19	22

Activity Plan 2025

INESC TEC exceeded its 2025 targets across all dissemination and engagement activities, except for advanced training courses, which remained close to the plan (22 vs. 23). This performance reflects strong growth in scientific visibility and external outreach, with notable overachievement in editorial roles, participation in international committees, events, and R&D Centre activities, particularly in the number of organised events and participants.

This positive deviation is closely linked to the strong involvement of INESC TEC researchers in editorial and scientific communities. Members held key editorial roles in leading journals, while also contributing extensively to programme and technical committees of major international venues.

The overperformance in organised events and participation figures is further explained by a strong portfolio of international conferences and scientific initiatives led or hosted by INESC TEC. A major highlight was ECML-PKDD 2025, one of the leading European conferences on Machine Learning, which brought over 1 300 participants to Porto and featured a comprehensive programme spanning scientific tracks, workshops, tutorials, and industry engagement. Additional high-profile events included VISIGRAPP 2025, with more than 380 participants, SRDS 2025 (the 44th International Symposium on Reliable Distributed Systems), and the joint IFAC flagship symposia ROCOND'25 and LPVS'25. The institute also hosted and co-organised other relevant international events such as "OFS29 – Optical Fiber Sensors Conference", the "12th EurOMA Sustainable Operations and Supply Chains Forum", and "PRO-VE 2025", reinforcing its role in convening global communities around topics such as sustainability, digital transformation, and collaborative networks.

Training and capacity-building activities remained aligned with strategic domains, despite slightly below-target figures. Initiatives covered key areas such as artificial intelligence, 6G communications, energy systems and sustainability, power systems simulation, ocean and acoustic technologies, geosciences and geotechnologies for extreme environments, and software and infrastructure engineering. International programmes (e.g., EUGLOH) and capacity-building actions in Africa further reinforced global engagement.

Beyond conferences and training, INESC TEC reinforced its international presence and public engagement through participation in major global events and outreach initiatives. The institute showcased its research

and innovation at leading international fairs such as Transport Logistic in Munich and ENLIT in Bilbao, as well as key forums in robotics and autonomous systems, including ERF 2025 and REPMUS 2025. At the same time, workshops, talks, and open days across R&D Centres fostered closer interaction with academia, industry, media, and society, promoting transparency and accessibility.

Finally, institute-wide initiatives such as the INESC TEC Autumn Forum, along with other transversal activities, continued to play a relevant role in the organisation's dissemination ecosystem, although not accounted for in these metrics. Overall, the sustained use of hybrid formats and strong international collaboration further enhanced participation, contributing to the inclusiveness and global reach of INESC TEC's dissemination activities.

4.6 Participation in Other Entities

In order to promote knowledge and competence sharing, INESC TEC is currently a full member of more than sixty Associations, at national and international levels. Other than the participation in the General Assemblies where network and benchmark are added values, INESC TEC actively participates in several Boards, Committees, and Working Groups, thus gathering and sharing knowledge with top-of-the art experts in its field of activity.

In 2025, INESC TEC expanded its network by joining five new associations: CNCA, CURRENT/OS, Linux Foundation for Energy, OGC, SUSTEMARE, and YEAR.

Table 4.14 - INESC TEC's participation in other entities

NATIONAL ASSOCIATIONS	
National Competitiveness Clusters	ACPMR (Mineral Resources), ADVID (Vines&Wines), AEDCP (Space and Defence), APICCAPS (Footwear and Fashion), BATPOWER (Energy), CITEVE (Textile), Fórum Oceano (Sea), HCP (Health), MOBINOV (Automobile), PFP (railway), PRODUTECH (Manufacturing), TICE.PT (CIT)
Collaborative Laboratories ***(See also Section 3.10.1)***	AQUAVALOR (Water technologies), B2E (Blue Economy), BUILT (Built Environment), FEEDINOV (Sustainable Animal Production), ForestWise (Fire and Forest), HYLAB (Hydrogen energy), Smart Energy lab (Energy Services), VG Colab (Energy storage), ADVID (Vineyard and Wine), VORTEX (Cyber-physical and cyber-safety systems), RAIL CoLAB (railway).
Dedicated to specific fields of knowledge	AdEPorto, IEP, APVE, CNCA, ITS Portugal, SPR, APDIO, APGEI, SmartWaste Portugal, EASTRO, INOMMOB, STICHTING SPRINT ROBOTICS COLLABORATIVE, SUSTEMARE.
Support industry/business	AEP
Promotion of science	Ciência Viva
INTERNATIONAL ASSOCIATIONS	
EIT Knowledge and Innovation Communities	EIT Manufacturing
Specific fields of knowledge	ADRA, AIOTI, ASTP Proton, ATE, BDVA CCILF, CERVIM, CIGRÉ, CENTRA, CRESYM, Current/OS, DERLab, EBRAINS, EARTO, EERA, EFFRA, EPIC, ERCIM, EES-UETP, ETSI, EuRobotics, EtherCAT Technology Group, Gaia-X, IAM-I, IEA Wind, IDSA, INESC P&D Brasil, Linux Foundations for Energy, OGC, RISC-V, ROS-INDUSTRIAL CONSORTIUM EUROPE, WA4ES, YEAR.
COMPANIES *(Non Spin-offs)*	
CEO - Companhia da Energia Oceânica	Since 2022, INESC TEC is the main shareholder of the company CEO – Companhia da Energia Oceânica, owner of an Aguçadoura's test zone with grid connection (4 MW of power), capable of supporting the development and testing of marine renewable energy technologies (TRL ~5-8), as well as other multi-purpose marine structures, marine robotics, telecommunications, advanced sensing, collection of ocean and environmental data for model development, among others. In addition to its strategic importance in the fields of Sea and Energy, it strengthens synergies with ongoing initiatives related to infrastructure, projects in progress, and research and development lines across various Centres.

Participation in Collaborative Laboratories

The Collaborative Laboratories – Bridging the Valley of Death

The Collaborative Laboratories (CoLABs) initiative was launched by the Portuguese Government in 2017 to strengthen the interface between research institutions and the market. These entities aim to create high-quality jobs in Portugal by advancing the social and economic valorisation of knowledge through demand-driven research and innovation.

The primary challenge CoLABs seek to address is the "valley of death" between academic research and market application. To this end, they foster institutionalised collaboration between science, technology, and higher education institutions and the broader economic and social fabric – companies, the healthcare sector, cultural bodies, and civil society organisations.

CoLABs are independent legal entities, typically structured as private non-profit associations or companies, and bring together diverse partners: universities, research units, state laboratories, interface institutions, companies, business associations, and public and social sector entities. They are characterised by their strong consortia, financial commitment, and business-led governance, and they operate with a focus on implementing medium-term research and innovation agendas.

Alignment with INESC TEC's strategy and evolution in 2025

As demand-driven, business-oriented institutions focused on high Technology Readiness Levels (TRLs), CoLABs provide a natural complement to INESC TEC's applied R&D and technology transfer strategy.

INESC TEC's engagement in the creation and development of several CoLABs reflects its commitment to bridging the "valley of death" and supporting public policy objectives related to innovation and competitiveness. By 2025, INESC TEC was formally associated with eleven CoLABs, all operating as private non-profit associations.

This participation reinforces INESC TEC's role as a leading interface institution, contributing to the deepening of application-oriented research, accelerating the valorisation of knowledge, and supporting the creation of high-value jobs, particularly for early-career researchers. CoLABs also provide a platform for experimentation with new forms of interaction between research, innovation, and societal needs, facilitating technology transfer, improving the market relevance of products and services, and increasing the societal uptake of academic research.

The tables that follow provide an overview of INESC TEC's participation in each CoLAB and key developments in 2025.

Table 4.15 - CoLAB AQUAVALOR

AQUAVALOR	
Name	AQUAVALOR - Centro de Valorização e Transferência de Tecnologia da Água – Associação
Description	Aims to boost thermal and mineral waters as anchor products for regional development and promotion of tourism throughout the year, particularly in low-density territories.
Areas of expertise	Health; Water technologies; Digital transition
Year of establishment	2018
No. of Associates / Accession of new Associates in 2025	25/ 0
HR hired	19
Competitive funding – submitted and approved proposals	Submitted: 3 586 223.67€ Approved: 1 734 699.45€ (BioLivingLABS, MushPastry, HealthBioFit, Tech4Aqua, NORTEtur Conectado, Investments in Technological Infrastructure – Bioproducts Vidago) Awaiting decision: 479 404.80€
Main activities and achievements in 2025	Development of projects focused on the scientific and economic valorisation of regional resources, including GIAHS (autonomous environmental monitoring), ORALTHERM (thermal water for oral health), THERM4SKIN (bioactive properties of thermal spring water for skincare), SUSTAINABLE TROUT (innovative food products from surplus trout), WOODLAND FUNGI (sustainable wild mushroom collection), 3RS (optimising cultivation of underutilised species), AQUAPRED (AI-based contamination control in mineral water), Inov@lheira e MushPastry (Innovation in traditional products), NORTEtur Conectado (PREI Turismo) e Investments in Technological Infrastructure - Bioproducts.
Activities to foster Associates' involvement	Preparation of proposals for several competitive funding calls (FCT/BPI La Caixa Promove 2025, Compete, Norte 2030, Horizonte Europa). The organisation of scientific and technical events.
Fulfilment of INESC TEC's strategic objectives related to this participation	INESC TEC's participation in the COLAB is driven by three core strategic objectives: (1) to leverage its competencies and expertise in digital technologies to actively support the COLAB's growth and consolidation; (2) to identify and develop new research, innovation, and business opportunities; and (3) to contribute to the sustainable development of low-density territories by attracting and retaining highly qualified human resources and enabling higher added-value economic activities. To date, the COLAB's trajectory has been aligned with these objectives. Several highly qualified professionals have been recruited to the organisation. Looking ahead, the increasing maturity of the COLAB - combined with the launch of the PT2030 funding cycle - creates a window of opportunity to substantially intensify this collaboration, particularly in research and innovation on the Agro-Food sector. It is essential that INESC TEC and the COLAB establish a more proactive, structured, and results-oriented relationship between their respective research and technical teams. This closer alignment will be key to co-designing ambitious R&I initiatives, maximising the leverage of available funding instruments, and positioning both organisations as reference players in Agro-Food innovation at national and European levels.

Table 4.16- CoLAB B2E

B2E	
Name	B2E - Laboratório Colaborativo para a Bioeconomia Azul
Description	B2E is a key driver of innovation in the Blue Bioeconomy, promoting research, development, and market-oriented solutions that combine sustainability with technological and economic progress. It aims to enhance the economic and social value of marine-based products and services – both existing and emerging – while supporting the internationalisation of national scientific and technological capacities. With this approach, B2E contributes directly to two blue growth sectors with high potential: biotechnology and aquaculture.
Areas of expertise	Living marine natural resources; Marine biotechnology; Sustainable aquaculture
Year of establishment	2019
No. of Associates / Accession of new Associates in 2025	15/ 1
HR hired	6 new
Base funding planned	526 931,57 €
Competitive funding – submitted and approved proposals	Submitted: 11 | Approved: 5 Pending approval: 6
Main activities and achievements in 2025	In 2025, B2E CoLAB consolidated its role as an interface organisation supporting the development of R&D and innovation projects in the blue bioeconomy. The CoLAB remained actively involved in national and European projects, including the PRR Pact for the Blue Bioeconomy, InsectERA, Horizon Europe INNOECOFOOD and FCT-funded initiatives, while also securing new approved projects such as BLUEVALSTEP and participating in regional smart specialisation platforms (e.g. PREMI). B2E CoLAB also reinforced its role in supporting stakeholders and public entities, namely through its advisory work with the Municipality of Matosinhos and its contribution to strategic planning processes related to the blue economy and sustainability. At the international level, the CoLAB strengthened its integration in European networks (e.g. BIC) and participated in key sector events such as Aquaculture Europe 2025, fostering collaboration opportunities. Additionally, B2E CoLAB continued to support knowledge transfer and capacity building, including advanced training, technical outputs and stakeholder engagement activities aligned with blue bioeconomy value chains.
Activities to foster Associates' involvement	R&I projects developed with associates; support in aligning associates' priorities with funding opportunities; stakeholder engagement processes; and participation in national and international networking and dissemination events.
Fulfilment of INESC TEC's strategic objectives related to this participation	Support the development of the blue bioeconomy, particularly in aquaculture and marine biotechnology, by enabling access to competitive funding, fostering R&D project development and strengthening collaboration between research, technology and industry.

Table 4.17 - BUILT CoLAB

BUILT CoLAB	
Name	BUILT CoLAB – Colaborative Laboratory for The Future Built Environment
Description	The BUILT CoLAB aims to develop research, innovation and knowledge transfer activities, with a view to increasing productivity, competitiveness and sustainable growth of the ecosystem of the AEC (Architecture, Engineering and Construction) sector, promoting the digital and climate transition of buildings and infrastructures, making them adaptable, intelligent, resilient and sustainable.
Areas of expertise	Digital and climate transition of buildings and infrastructures
Year of establishment	2019
No. of Associates / Accession of new Associates in 2025	20 / 0
HR hired	4 HR were hired by the CoLAB in 2025
Base funding planned	864 250.64€
Competitive funding – submitted and approved proposals	Were submitted: 7 Horizon Europe proposals, 4 PT2030 Copromotion, a SMP COSME, 2 LIFE CET, 2 Cosmic cascade funding, 3 tender applications. In 2025 were approved: 4 Communicity Cascade funding projects, a Horizon Europe, a LIFE CET, and a PT2030 Copromotion (mini-agenda).
Main activities and achievements in 2025	BUILT CoLAB has developed several impactful projects in 2025 and has grown significantly in 2025 in number of projects, researchers, research, service provisions and external recognition. It has also a year of achievements in terms of European Projects, recognitions and service provisions (with a significative growth). 2025, has also been a consolidation year in terms of the team, processes and methodologies. Several initiatives with Associates and with the AEC sector, in general, have also been developed to promote the twin transition of the Construction sector, including all stakeholders and in several dimensions.
Activities to foster Associates' involvement	Meetings with the associates to present the skills, needs and promote co-creation/collaboration; Development of common competitive funding opportunities; Invitation to events, communication initiatives or business opportunities; the involvement of some in DIGITALbuilt (an EDIH); the establishment of partnerships to licence and scale technology; and the development of several bilateral projects that will support activities in the twin transition of partners.
Fulfilment of INESC TEC's strategic objectives related to this participation	Open a new market for INESC TEC to apply its skills and apply technology already developed for other sectors. Participated in several large national and European project proposals.

Table 4.18 - CoLAB FEEDINOV

CoLAB FEEDINOV	
Name	FEEDINOV - Associação para a Investigação e Inovação em Nutrição e Alimentação Animal
Description	Aims to improve safety along the food chain, with an impact on the safety of animal products, increasing consumer confidence in domestic production and strengthening the role of the animal feed industry in the production of healthy, sustainable and environmentally friendly products
Areas of expertise	Safety, quality and sustainability of feed and food production; Competitiveness of the livestock sector; Environmental sustainability
Year of establishment	2019
No. of Associates / Accession of new Associates in 2025	18/ 2 available places in the consortium awaiting acceptance decision from the general assembly
HR hired	A base team of 10 HR. The associates have 6 HR's assigned part time (5-10%) to the CoLAB.
Base funding planned	€1.1M from October 2023 to March 2026 + reinforce of 91661,67€ from March to June 2026
Competitive funding – submitted and approved proposals	4 competitive proposals were submitted, 4 are still awaiting response. Approval of submitted co-promotion PT2030 project "SmartFertilizers" joint with INESC TEC.
Main activities and achievements in 2025	Achievements included coordinating an international Horizon Europe consortium application with INESC TEC, initiating animal studies with GreenFeed® equipment (Mission Interface funding). The year 2025 was also marked by closing PRR funded projects FeedValue and UsamSuLei, with links to the livestock sector. Submission and approval of SmartFertilizers project promoted by Herculano, to start in 2026.
Activities to foster Associates' involvement	B2B initiatives with private associates provided a closer link to these associates. Cooperative and co-creation Workshops under project EUNetHorse and STEP-UP allowed a closer link with some associates. Joint submissions with INESC TEC and participation in activities promoted by associates.
Fulfilment of INESC TEC's strategic objectives related to this participation	Participation in FeedInov CoLAB continues to prove promising, given that until INESC TEC joined the CoLAB, it had no relevant activity in the field of livestock, and the situation has been changing. However, there is a risk that the CoLAB will continue to focus excessively on animal feed and IACA, to the detriment of a greater focus on precision livestock farming, which is more in line with the activity of TEC4AGRO-FOOD. It will be necessary to monitor the evolution of the CoLABs model within the scope of the new Science Law.

Table 4.19 - CoLAB FORESTWISE

CoLAB FORESTWISE	
Name	ForestWISE – Associação para o Laboratório Colaborativo para a Gestão Integrada da Floresta e do Fogo
Description	Brings together multiple interdisciplinary areas for a holistic and cohesive approach to rural fires and the closely related issue of the valorisation of forest (market and non-market) products and services.
Areas of expertise	Sustainable Forest Management; Knowledge and Technology Transfer
Year of establishment	2018
No. of Associates / Accession of new Associates in 2025	16
HR hired	16
Base funding planned	45 HR hired by the CoLAB by the end of 2025
Competitive funding – submitted and approved proposals	962 873,47€
Main activities and achievements in 2025	In 2025, CoLAB ForestWISE continued to strengthen its ability to attract R&D opportunities, recording an execution value of €3,062,008 under funded projects. In the area of service provision, more than €700,000 was secured during the year. Service provision invoicing totalled €427,954, including amounts related both to services secured in 2025 and to work arising from previous periods.
Activities to foster Associates' involvement	Throughout the year, CoLAB ForestWISE focused on consolidating and enhancing the results of its flagship projects, strengthening the link between research, innovation, and practical application. RN21 continued to reinforce the relevance of the natural resin value chain, with particular emphasis on the Resinae brand, while the transForm Agenda entered its concluding phase, maintaining its focus on digital transformation, sustainability, and the competitiveness of the forest-based sector. At the same time, the BioShoes4All and Be@T projects showed a more mature stage of development, with growing market proximity and stronger promotion of sustainable bio-based solutions. In the area of advanced capacity building, B-READY4FUTURE strengthened specialised training, while FIRE-RES moved closer to completion, with a focus on consolidating results and transferring knowledge to territories.
Fulfilment of INESC TEC's strategic objectives related to this participation	In 2025, CoLAB ForestWISE maintained an active presence in promotion and dissemination initiatives, strengthening the sharing of knowledge and results with companies, public entities, academia, and other actors involved in integrated forest and fire management. The newsletter continued to serve as a central communication tool with Associates, stakeholders, and the wider community, ensuring regular engagement with the CoLAB's activities, projects, and events. At the same time, the collaborative projects and initiatives underway continued to foster close and ongoing interaction with a broad range of partners, reinforcing the connection between science, innovation, and practical application in the territory.

Table 4.20 - HYLAB CoLAB

HYLAB	
Name	HYLAB – Green Hydrogen Collaborative Laboratory
Description	Aims to set up a network of competencies in R&D and new technologies aimed at the scientific and technological development of Green Hydrogen, covering the various components of the value chain.
Areas of expertise	Green hydrogen
Year of establishment	2021
No. of Associates / Accession of new Associates in 2025	14 / 0
HR hired	28
Base funding planned	HyLab started the Research and Development activities in 2025, with a fast-paced development of HR, laboratory facilities and specialised software acquisition. At the end of 2025 the base funding execution reached 70%.
Competitive funding – submitted and approved proposals	By the end of 2025 had 3 new projects approved: AQUA-2-METHAN3X – Integrated Process using Water Harvesting Technologies for Hydrogen Production and Biogenic CO2 Valorisation into Methane (P2030); SHIELD - Safety and Multi Hazard Identification for resilient European Hydrogen Infrastructure and Logistics (HEU); and GreenH2Atlantic - A 100 mw flexible green hydrogen production process sourcing hybrid renewable energy and supplying green hydrogen to multiple end-uses (H2020)
Main activities and achievements in 2025	5 new team members (1 Funding Programmes Manager and 4 researchers); Approval of 5 PhD applications in a Non-Academic Environment (FCT 2025 Call). 3 new equipped laboratories (Separation and Conversion, Combustion and Prototyping and Hydrogen Safety) Approval of the Reprogramming of Mobilising Agendas, that led to the recovery SinesH2GreenValley (€3.4M) and the reinforcement of €600k in the HyLab budget in the remain projects. Start of the Project HySEas and AQUA-2-METHAN3X ; Provision of 2 services devoted to specialised H2 training. Contribution to a new National Regulation – Hydrogen Refueling Stations
Activities to foster Associates' involvement	During 2025, the main activities with associates were devoted to on-going projects and new project proposals. HyLab developed 26 proposals, most of them with associates' involvement. Regarding the involvement of INESC TEC the most important was H2SYMBIOTIC - Multi-Sector Hydrogen Integration for Decarbonisation and Circularity, which was awarded early 2026.
Fulfilment of INESC TEC's strategic objectives related to this participation	INESC TEC has been looking at the opportunities hydrogen offers to foster the energy transition, namely regarding energy storage and security of supply of electric power systems, balancing ancillary services provision through eletrolysers and exploitation of gas networks with blended H2. HyLab provides the network of competences and synergies to further develop this strategic vision.

Table 4.21 - RAIL CoLAB

RAIL CoLAB	
Name	RAIL COLAB - COLLABORATIVE LABORATORY FOR THE FUTURE RAILWAY SYSTEM
Description	Aims to promote and carry out of R&D initiatives and activities aimed at improving the railway system, through scientific support and technological innovation in the intervention of relevant players in the business, academic and economic fabric
Areas of expertise	Rail
Year of establishment	2022
No. of Associates / Accession of new Associates in 2025	17
HR hired	1
Base funding planned	0
Competitive funding – submitted and approved proposals	FCT and STEP submissions. Value not disclosed yet.
Main activities and achievements in 2025	General Assembly was not held yet and there is no 2025 report available yet. The available information is the following: • A collaborator was hired, starting in September 2025. • An agreement was signed to access a rail wagon and transform it into a live laboratory. • Submissions to FCT and STEP related calls were carried out, but no details available. • An online inquiry to create a competence matrix was launched. A new Board will be elected in an upcoming GA, no date defined yet. Only one list was presented, following previous strategic lines.
Activities to foster Associates' involvement	No detailed information available.
Fulfilment of INESC TEC's strategic objectives related to this participation	Until now the growth of involvement of INESC TEC in Rail has been through Centro de Competências Ferroviárias, with active discussions to launch projects, with an approval (SMART BOGIE). The innovation domain in the Rail national ecosystem has too many competing entities: Cluster PFP, Centro de Competências Ferroviárias and RAIL CoLAB. INESC TEC participates in PFP and RAIL CoLAB. Although all claim to complement each other, overlapping is clear.

Table 4.22 - CoLAB Smart Energy Lab

CoLAB SEL	
Name	SMART ENERGY LAB – ASSOCIATION
Description	Pioneering Innovation for Energy Transition and Economic Growth, committed to advancing electric renewable energy, SEL helps businesses drive economic value in the Energy Transformation and Decarbonizstion. Our innovative, market-ready solutions enable customers to optimise their energy use and transition to cleaner renewable energy.
Areas of expertise	New Energy Management Solutions, Electric mobility, Electrification
Year of establishment	2019
No. of Associates / Accession of new Associates in 2025	7 / 7
HR hired	6 new HR have been hired in 2025 adding to existing 56 in 2025, with a total of 60 people on 31st December 2025.
Base funding planned	Subsidies (state and other public entities): PRR: 4 092 412; Horizon Europe: 241 519; Colab Base Funding Missão Interface: 811 588 Total: 5 145 519€
Competitive funding – submitted and approved proposals	- Horizon Europe: Submitted proposals: 10 (with a total budget: 1,8M€)/ Approved proposals: 0, some still waiting for results. Ongoing projects: 5 (with a total executed in 2025 of 242k k€). Life +: Submitted proposals: 2 (with a total budget: 935k€). EIC submitted proposals: 2 (with a total budget: 1,36M€). PRR Agendas Mobilizadoras Ongoing projects: 3 (with a total executed in 2025 of 4,09 M€ from a total budget for 2023-2026 of: 15,9 M€).
Main activities and achievements in 2025	SEL focused on 19 main projects across three streams: Consulting, R&D Funded Projects, and IP/Product development, with a primary focus on EDGE (e-mobility), REEF (energy management), B2B Heat Eletrification and a new stream called SEL Plaform. Key 2025 highlights include the first applications to new EU funding schemes (EIC, Eureka, Erasmus+), First B2B sale with edge, 2 MoU with industrial partners, presence in CNN Inovação, 1st presence in a investment forum outside of Europe, in Africa, office improvements with new showroom, Updated EDGE (Maestro, Controller and Beat) and Reef (Maestro, Controller, Beat) portfolio.
Activities to foster Associates' involvement	- Monthly board meetings with the Associates with representation from Industry and Academia - Direct interaction in PRR Agendas Mobilizadoras projects coordinated by SEL and with specific R&D streams with INESC TEC, CPES: Algorithms for Energy Managemet: João Paulo Viana ; Wallboxes Integration: José Silva; Batteries Integration: Vasco Campos; Flexibility Agregation: Ricardo Bessa - Horizon Projects applications in topics of flexibility and e-mobility. - Contacts for human resources exchange and between both entities and subcontracting opportunities partners.
Fulfilment of INESC TEC's strategic objectives related to this participation	The main active streams in 2025 include PRR Agendas Mobilizadoras (Consortium ATE) with the 4 streams mentioned above and Horizon Europe Projects (Enershare), where INESC TEC and SEL collaborate on E-mobility, Flexibility, and Energy Management Systems. Opportunities for human resources exchanges and more intensity in proposal preparation have been occurring in 2025, compared to previous years.

Table 4.23 - CoLAB Vasco da Gama

CoLAB Vasco da Gama	
Name	Vasco da Gama CoLAB – Energy Storage - Associação
Description	Focused on high-tech services, value-added products, and innovative solutions in electrochemical energy storage, aiming to support the European energy transition with world-leading technologies
Areas of expertise	Electrochemical energy storage; Electronic energy conversion; Intelligent energy management
Year of establishment	2019
No. of Associates / Accession of new Associates in 2025	9 / 1
HR hired	6
Base funding planned	€601k
Competitive funding – submitted and approved proposals	In 2025, VG CoLAB submitted 30 proposals for competitive funding to European and national programmes such as Horizon Europe, COMPETE2030, NORTE2030, Interreg POCTEP, Interreg Atlantic Area and EIC Pathfinder focused on energy storage, batteries and grid interface. In 2025, 5 projects were approved/initiated: ePTOMASS, H2Driven, ATE, BIOESSSC and POMCELL.
Main activities and achievements in 2025	In 2025, VG CoLAB focused on the TRL scale-up of previous developments, also aligned with the requirements associated with the HE and PRR projects' deadlines. Regarding electrochemistry, the team has successfully developed innovative materials for sodium-ion and supercapacitors, resulting in one scientific publication and two patents (ongoing processes). The battery modules & packs team (currently renamed to System Integration) has successfully validated thermal modelling of battery modules for 5C continuous discharging, estate estimators to Li-based chemistries (NMC and LFP) with 95%+ accuracy (a scientific article will be released), distributed balancing systems, eFuses, and interoperability with external systems (wirelessly and wired). The power electronics team has successfully developed and validated high-power inverters (classical fast power response system < 5 ms) and modular power electronics technologies, that currently being scaled to TRL 7.
Activities to foster Associates' involvement	Periodic bilateral meetings with associates / Regular scientific committees with associates / Invitation for European projects / Execution of ongoing development projects
Fulfilment of INESC TEC's strategic objectives related to this participation	INESC TEC's participation significantly contributed to achieving the institution's strategic objectives, evolving from previously discussed opportunities and shared interests into concrete activities and achievements throughout 2025. Ongoing projects (i-STENTORE and the Mobilising Agenda 'NGS-New Generation Storage'), alongside the preparation of several Horizon Europe applications for 2025 and 2026 demonstrate the materialisation of the international collaboration strategy.

Table 4.24 - CoLAB Vines&Wines

CoLAB Vines&Wines	
Name	Vines&Wines - Vinha e Vinhos Portugueses, Competitividade e Sustentabilidade
Description	Mission: Develop and communicate knowledge and technology to support the wine sector's goal of a 25% export value growth in five years and to adapt the national wine system to major challenges, particularly climate change
Areas of expertise	Viticulture; Agronomy; Oenology; Product and service development
Year of establishment	2019
No. of Associates / Accession of new Associates in 2025	204 / 5
HR hired	43 (33 from Associates + 10 from staff)
Base funding planned	261 224,84€
Competitive funding – submitted and approved proposals	5 proposals submitted | 2 proposals approved
Main activities and achievements in 2025	Implementation of a Pilot in the Wine sector to monitor traceability from vineyard to cellar, with INESC TEC in the project WATSON. Collaboration on the development of good practices to manage green infrastructures in vineyard landscapes to promote ecosystem services. Collaboration and development of Living Labs to improve soil health on vineyards (project LivingSoill). Supplementation of viticultural, climatic, and biological data to enhance yield prediction models in the Wine4cast project. Development of training sessions on Sustainable Winegrowing Practices.
Activities to foster Associates' involvement	Workshops, seminars and dissemination including technical bulletins. Technology/machinery demonstration sessions in the vineyard. Collaboration for partnerships in R&D projects and funding applications. Assistance/supervision in the development of Sustainability plans.
Fulfilment of INESC TEC's strategic objectives related to this participation	Participation in ADVID COLAB VINES&WINES allows to be closer to the needs and desires of winegrowers, facilitating the implementation of the "innovation triangle" and, consequently, the research and technological development of innovative solutions for the sector. It will be necessary to monitor the evolution of the CoLABs model within the scope of the new Science Law.

Table 4.25 - CoLAB VORTEX

CoLAB VORTEX	
Name	Vortex – Associação para o Laboratório Colaborativo em Sistemas Cíber-Físicos e Cíber-Segurança
Description	Aims to be National leader and European reference in Cyber-Physical Systems, accelerating solutions and technology blocks to enable co-creation and technology transfer
Areas of expertise	Cybersecurity and Cyber-Physical Systems
Year of establishment	2019
No. of Associates / Accession of new Associates in 2025	5 / -
HR hired	There was hiring, but only to maintain the overall head count at 42
Base funding planned	€661k
Competitive funding – submitted and approved proposals	14 proposals submitted in 2025 (12 rejected, 2 waiting for result)
Main activities and achievements in 2025	The year was marked by strong performance across all three funding pillars. Competitive funding reached its highest level to date at €1.56M, growing 22% year-on-year and representing 57% of total revenues, driven by active participation in Chips JU programs POEMS and Rigoletto, and the extension of Route 25. Commercial revenues grew 9% to €428k, supported by three contract research projects with Capgemini Engineering in software-defined vehicles and AI-based medical applications. VORTEX closed the year with a net profit of €163,632, reversing the previous year's loss, and total revenues of €2.65M. Internally, 2025 was a year of consolidation. Organisation-wide adoption of Agile was completed, Jira was rolled out as the central project tracking system, a structured Career Plan was launched, and Internal Regulations were formally approved. Cross-area collaboration deepened significantly, with several flagship projects drawing simultaneously on Embedded, Safety, Cybersecurity, and Innovation teams - a shift from area-based to initiative-based ways of working that proved effective and will be further embedded in 2026. The main structural challenge of the year was the continued decline in base funding, which fell to 25% of total revenues from 46% in 2023, reinforcing the need to actively rebalance the funding mix. Externally, the delayed publication of the Horizon Europe Work Program 2025 compressed the submission calendar in the first half of the year, and the ongoing merger of ANI and FCT introduced regulatory uncertainty that required active monitoring.
Activities to foster Associates' involvement	Partners participate in advisory and supervisory activities and proposals for competitive funding are done in collaboration with partners. Master and Ph.D. students are co-advised.
Fulfilment of INESC TEC's strategic objectives related to this participation	This is the time to reassess INESC TEC's strategic objectives. The management structure of VORTEX will change due to i) the replacement of the managing director, ii) a new funding program is uncertain, and iii) the partner structure of the Colab (both on the industrial side with the change from Altran to CapGemini and the natural evolution of academic institutions) has diverged from the original configuration. The potential for collaboration with CapGemini remains, but this is orthogonal to the future of VORTEX.

4.7 Activities within the Scope of INESC TEC's Recognition as a Technology and Innovation Centre (CTI)

Presentation

INESC TEC's recognition as a Technology and Innovation Centre (CTI) by the Portuguese Government, renewed in 2023, reinforces its role as a science-based innovation institution operating at the interface between research, industry and society. This recognition supports a model that combines the generation of advanced knowledge with its translation into technologies, services, collaborative projects and innovation-oriented capabilities with economic and societal relevance.

Within this framework, INESC TEC contributes to strengthening the competitiveness of companies and strategic sectors through technology transfer, industrial collaboration, advanced training, support to digital and sustainable transformation, and the promotion of innovation ecosystems. The CTI scope is particularly relevant in enabling activities that go beyond the logic of individual competitive projects, helping to reinforce institutional capacities, support small and medium-sized enterprises, and create conditions for the adoption and scaling of science-based innovation.

The activities developed in 2025 reflect this broad mission. They include direct engagement with companies, the delivery of training and capacity-building programmes, support to technology valorisation and entrepreneurship, outreach and ecosystem-building initiatives, and participation in European collaborative dynamics that reinforce INESC TEC's role in industrial innovation and strategic technological development.

Highlights in 2025

Key developments in 2025 under INESC TEC's CTI recognition include:

- **Engagement with industry.** INESC TEC's R&D activities, through competitive projects and direct contracts, involved more than 89 SMEs and 40 large enterprises, supporting them in the development and adoption of digital products, services and industrial processes. These collaborations addressed areas such as energy, smart manufacturing, automation, IoT, AI-based analytics and advanced monitoring, reinforcing the institute's contribution to industrial modernisation and innovation capacity.
- **Capacity building.** INESC TEC expanded its capacity-building activities through training programmes in industrial digitalisation and Industry 4.0, including practical applications of IoT and AI. A new iiLab training plan was developed for companies, focused on digital transformation on the shop floor and the strengthening of workforce skills for technology adoption. In the energy sector, INESC TEC continued the annual training programme for the Portuguese TSO and launched a new advanced course with the JRC on semantic interoperability, supporting alignment with European interoperability frameworks and the digitalisation of the sector.
- **Outreach and dissemination.** INESC TEC reinforced outreach and ecosystem-building activities through events such as Synergy Day, focused on robotics for the agroforestry sector, the Winter Workshop on scientific infrastructures, and the Summer Workshop on EU strategic autonomy and defence R&D. The 10th Autumn Forum gathered 515 participants, while the sessions The Shape of Energy to Come 2025 and the Energy Technology Open Day brought together more than 460 researchers, companies and policymakers around topics such as smart grids, electric mobility, decarbonisation and AI. International outreach was further strengthened through participation in ADRForum, ARTEX and Digital Navigator, as well as through the organisation of a dedicated session at the LF Energy Summit Europe.
- **Technology valorisation and IP.** The Technology Transfer Office consolidated its capacity to identify and protect R&D results, with 70 new disclosures mapped for potential IP protection and 19 new priority filings in 2025. One new spin-off was launched, while awareness and support activities continued to strengthen strategic IP management and technology-based entrepreneurship. These developments contributed to improving the conditions for transforming

research results into protected technologies and innovation opportunities with market and societal relevance.

- **Internal talent development.** CTI-related activities also contributed to strengthening internal capabilities in innovation and technology transfer. In 2025, this included training actions in intellectual property and open-source software, support to the development of entrepreneurship-related competences, and contributions to advanced training initiatives connected to innovation management and knowledge transfer. These efforts help reinforce the institute's internal readiness to support science-based innovation and its application in industrial and societal contexts.
- **European engagement.** INESC TEC reinforced its contribution to the European R&I agenda and its role in supporting national companies in international consortia. In 2025, around 170 European project proposals were submitted, and INESC TEC coordinated around 10 of the 13 European projects that kicked off during the year. This European engagement strengthens both the institute's international positioning and its capacity to bring companies and other stakeholders into collaborative innovation dynamics at European level.
- **Infrastructure upgrading and testing capabilities expanded**: Laboratory infrastructure was strengthened in robotics, energy, bioengineering and advanced computing, enabling new testing capabilities.
- **Digital Transformation**: Improving organisational workflows and management through the rollout of a new ERP system supporting financial and HR operations and the formalisation of the Project Management Office. Development of a new institutional website, improving institute outreach.
- **Strengthening competences and technologies in circular economy and decarbonisation, AI and Cybersecurity**: Significant technological developments were achieved, including the industrialisation of solutions for the energy sector, namely Predico and CEVESA platforms. Demonstrators were completed in traceability and digital product passports, digital twins, industrial digitalisation roadmaps and natural language processing tools. Cybersecurity capacities, with new methodologies developed for assessing vulnerabilities in industrial robotic systems. In the field of AI, notable progress included the integration of GenAI in robotic digital twins, pallet-detection systems and the modular E-Platform.

5 INESC TEC SCIENTIFIC DOMAINS

As mentioned in Section 2, research at INESC TEC is centred around eight Scientific Domains – Artificial Intelligence (AI), Bioengineering (BIO), Communications (COM), Computer Science and Engineering (CSE), Power and Energy Systems (PES), Photonics (PHT), Robotics (ROB), Systems Engineering and Management (SEM). The next section presents those Scientific Domains and their objectives.

5.1 ARTIFICIAL INTELLIGENCE

Steering Committee: Alípio Jorge, Andry Pinto, Jaime Cardoso, João Gama, and Rita Ribeiro

Presentation of the Domain

Artificial Intelligence is a decades-old scientific domain which has recently boosted its importance and impact in science, the economy and society in general.

Artificial Intelligence (AI), while rooted in Computer Science, draws on a broad range of disciplines including mathematics, neuroscience, linguistics, psychology, philosophy, and physics. Research in this domain reflects this interdisciplinary nature, advancing both foundational and applied aspects of AI. In recent years, significant progress has been driven by machine learning, particularly deep learning and generative AI, which have transformed the interpretation and generation of speech, images, and audio. Current research builds on these advances to develop more powerful, adaptable, and general-purpose AI systems, while also revisiting the symbolic foundations of AI through neuro-symbolic approaches that enhance explainability and transparency.

A central research focus lies in addressing the dual challenge of data dependence and human-centric design. While modern AI systems require large volumes of high-quality data, research increasingly emphasises approaches that ensure trustworthiness, interpretability, safety, and robustness. This includes developing methods for efficient data use, as well as frameworks that place humans at the centre of AI system design and operation.

The diversity of real-world interaction scenarios drives research across multiple complementary directions. These include human modelling, such as theory of mind, as well as human-AI collaboration and oversight. Additional efforts focus on interaction design, usability, and user experience, alongside information visualisation and visual analytics to support understanding and decision-making. Research also addresses the explanation and verification of AI processes and results, contributing to more transparent and accountable systems.

Finally, the increasing capabilities of AI systems require dedicated research on their risks and societal implications. This includes the development of ethical-by-design approaches aligned with European and international guidelines, ensuring that AI deployment minimises potential harm. At the algorithmic level, research continues to explore large-scale models based on deep and reinforcement learning, while addressing their limitations, including high data requirements and limited interpretability. Improving the transparency, efficiency, and controllability of these complex and often opaque systems remains a key priority in the domain.

Research Challenges

A) Build highly valuable and reusable AI resources

Algorithms are the central component of AI development, driving the combination and evolution of both classical and modern approaches across symbolic and sub-symbolic paradigms to address current challenges. These approaches operate over diverse types of input data and across different regimes, ranging from static to streaming environments.

Beyond processing information, AI systems increasingly rely on models as key representations of knowledge. Accordingly, research focuses on the creation of reusable, extensible, and continuously refinable models, including live and responsive systems such as digital twins. As these models grow in complexity and adaptability, significant effort is devoted to their continuous evaluation and management,

combining human-centred strategies with automated solutions such as AutoML for model and algorithm selection.

Data is treated as a critical asset, motivating work on its full lifecycle, including generation, collection, curation, management, dissemination, and use. Techniques such as data augmentation and synthetic data generation are explored to address data scarcity in many application domains. Finally, the development of intelligent systems requires integrated pipelines that combine AI and non-AI components while accounting for human interaction in complex environments. These pipelines are designed as reusable assets, supporting efficient deployment and operation of AI solutions.

B) Exploit models and algorithms for advanced tasks

Foundation models can solve previously unseen problems, and research focuses on how to effectively exploit them under limited training conditions. This includes their use in zero-shot and few-shot settings, their integration into AI pipelines, and their combination and stacking to generate representations at different levels of abstraction. These models are also reused across new domains and interacted with through natural language, enabling flexible use through prompting.

At the same time, models are increasingly treated as complex entities, almost akin to natural phenomena, motivating efforts to better understand their internal mechanisms and behaviour. This deeper understanding is essential for improving models and driving further developments in AI.

In parallel, symbolic algorithms and models, including those based on network science, are explored as complementary approaches to neural methods. While they may not match neural approaches in predictive performance, they are particularly valuable in scenarios with limited data, where external knowledge must be incorporated, or where interpretability and effective communication with humans are required. This supports the development of neuro-symbolic approaches that go beyond optimising prediction accuracy by combining the strengths of both paradigms.

C) Produce AI models that humans can inspect, understand, learn with and contribute

Human-AI interaction is becoming increasingly complex, requiring the integration of expertise from both computer science and the human sciences. Research therefore focuses on enabling effective collaboration between humans and AI systems, supported by sophisticated modelling approaches that ensure trustworthiness and explainability.

A key aspect of this effort is enabling humans to inspect and understand AI algorithms, pipelines, and models. This is essential for identifying and correcting errors, as well as for increasing safety and trust. Work in this area includes the verification of increasingly complex systems and programs, supported by advanced visualisation techniques.

At the same time, it is crucial to anticipate and mitigate the risks and broader impacts of AI systems on individuals and society. This involves systematically incorporating considerations such as privacy, safety, freedom, employment, and overall wellbeing throughout all stages of AI development and deployment.

D) Learn models and deploy AI Efficiently

The strong data requirements of current AI solutions, combined with the high cost of acquiring and managing data, motivate research into more data-efficient approaches. This includes exploring new methods for generating and exploiting data, as well as developing algorithms capable of incorporating feedback from the environment, as seen in reinforcement learning.

In parallel, alternative machine learning frameworks are being investigated to overcome the limitations of conventional approaches. This includes research in photonics, combining paradigms such as extreme learning machines, reservoir computing, and diffractive neural networks to enable the development of all-optical AI processors and platforms. These approaches offer significant advantages in terms of processing speed, scalability, and energy efficiency.

E) Enhance perception in dynamic, noisy, and multimodal scenarios

Research focuses on the development of intelligent decision support systems that combine audio-visual data with additional information from sensors and other external sources. These systems aim to enhance analysis and decision-making processes while ensuring the efficient handling of large volumes of data.

A key challenge lies in adapting machine learning models, particularly deep learning approaches, to the complex and dynamic conditions of audio-visual data. This includes work on model compression and acceleration, explainable and uncertainty-aware architectures, multimodal learning, efficient annotation strategies, open world learning, and domain adaptation, as well as the integration of domain knowledge.

In parallel, efforts are directed towards integrating heterogeneous sources of information, bringing together the semantics of text, knowledge bases, ontologies, sound, and images to support more comprehensive and robust multimodal AI systems.

Featured Contributions in 2025

In 2025, the Artificial Intelligence domain at INESC TEC delivered a diverse and impactful set of contributions, reinforcing its position across core AI, multimodal learning, health applications, responsible AI, and human-centred systems.

- Significant advances were achieved in **multimodal and perception-driven AI**, including the creation of a large-scale dialogue-attended audiovisual dataset comprising 280,000 video clips paired with rich dialogue-based descriptions, enabling more sophisticated video understanding and generation tasks. New methodologies for multimodal video classification and music generation further demonstrated the ability to fuse heterogeneous data sources with varying temporal and structural properties. Complementing these efforts, a unified architecture for visual scene description supported complex 3D scene understanding and synthesis, advancing capabilities in high-level visual reasoning.
- In **health**, multiple contributions highlighted the growing maturity of AI for medical applications. These include interactive segmentation frameworks for lung nodules based on advanced U-Net architectures, as well as lightweight and interpretable capsule network models for nodule characterisation. Progress was also made in concept-based explainable AI for medical image classification, enabling diagnoses grounded in human-interpretable features, alongside novel model-agnostic saliency methods based on information bottleneck principles to improve transparency in decision-making.
- The **natural language processing and data-centric AI agenda** saw major achievements, particularly in resources and models for European Portuguese. Several high-impact publications (AAAI, ACL, EMNLP) introduced new datasets and models for language variety identification, translation, and narrative extraction. In parallel, systems such as MedLink and Physio demonstrated the application of AI to clinical decision support and healthcare assistance, both receiving international recognition. Advances in core AI included novel neural architectures such as the Read-write LSTM, while spatiotemporal intelligence was strengthened through the release of large-scale transportation datasets.
- Research in **real-time and streaming AI** produced a strong portfolio of methods addressing concept drift, online learning, and adaptive data stream processing, with multiple publications in top-tier journals. These contributions are particularly relevant for dynamic and high-velocity environments where models must continuously adapt to changing conditions.
- The domain also made important strides in **responsible and ethical AI**, including a multidimensional framework for AI auditing presented at AAAI, and international recognition through the Cor Baayen Award for research in data quality and ethical AI. These efforts reinforce INESC TEC's commitment to trustworthy, transparent, and socially aligned AI systems.
- In **human-centred AI and education**, innovative approaches were developed for AI-mediated learning, including large language model-based tutoring systems to support self-regulated learning and structured AI co-teaching practices. These were complemented by international dissemination and collaboration, as well as capacity-building initiatives for AI literacy among students and staff.
- At the systems and infrastructure level, progress was achieved in **AI deployment and hardware-software co-design**, including automated adaptation of code to AI-oriented RISC-V architectures,

support for ONNX-based model interoperability, and novel full-system simulation frameworks enabling integration of custom accelerators.

- Finally, advances in **domain adaptation and knowledge extraction** were demonstrated through pipelines for corpus construction and lexical drift detection, including the adaptation of large language models to specialised domains such as the military, enabling robust entity recognition and information extraction in operational contexts.

Overall, these contributions reflect a coherent alignment with the domain's strategic priorities - ranging from multimodal intelligence and scalable AI systems to explainability, ethical AI, and real-world deployment - while showcasing strong scientific excellence and societal impact.

5.2 BIOENGINEERING

Steering Committee: Ana Maria Mendonça, Hélder Oliveira and João Paulo Cunha

Presentation of the Domain

Bioengineering is a rapidly growing and evolving scientific domain at the intersection of engineering and the life sciences. It combines fundamental engineering principles, practices, and technologies in medicine, biology, and environmental and health sciences to provide practical solutions to problems in these fields. The domain includes (but is not limited to) the development of mathematical theories and models, physical, biological, and chemical principles, computational models and algorithms, and devices and systems for clinical, industrial, and educational applications.

The Bioengineering Scientific Domain (SD BIO) of INESC TEC is strategically positioned to advance scientific and technological innovation in bioengineering by integrating fundamental discoveries with translational research, advanced training, and value-driven innovation. By integrating a highly multidisciplinary team of 58 researchers and PhD students distributed across six R&D Centres (51% C-BER, 28% CTM, 7% CAP, 5% HUMANISE, 5% CRIIS, and 3% LIAAD), the Domain consolidates a robust critical mass capable of addressing complex and emerging biomedical challenges. This strategic integration fosters synergies across engineering, life sciences, and digital health, driving the development of disruptive solutions that strengthen INESC TEC's leadership in bioengineering research and its impact on healthcare innovation.

Guided by this vision, the SD BIO directs its efforts toward four strategic objectives:

1. To foster the generation of interdisciplinary knowledge that drives innovation, technology transfer, and measurable economic and societal impact.
2. To develop advanced bioengineering methodologies and tools that enable disease prevention, early detection, and diagnosis; support healthy ageing, rehabilitation, occupational health, and well-being; and enhance the understanding of environmental–biological interactions.
3. To accelerate the creation of breakthrough technologies at the intersection of engineering, medicine, biology, and environmental sciences, ensuring their effective translation into global health and technology markets.
4. To strengthen internal synergies and establish strategic partnerships across INESC TEC Centres, clinical institutions, research organisations, MedTech companies, and startups, while cultivating an extensive international collaboration network with leading R&D centres worldwide.

Research Challenges

A) From Macro-to-Nano Scale Biosensing

Biosensing technologies are undergoing a transformative evolution toward ever-smaller and more integrated scales, turning biosensing into an accessible and ubiquitous technology - often designed for connectivity within the Internet of Things (IoT). This miniaturisation and integration open unprecedented opportunities for innovation across multiple bioengineering domains.

The overarching goal of this challenge is to design and develop next-generation biosensors and bioactuators - including bio-electrochemical, optical, and photonic micro- and nanoscale platforms - capable of interfacing seamlessly across macro-to-nano biological environments. These technologies will underpin advanced applications such as wearable and skin-conformal biosensing for sports performance optimisation and chronic disease management; implantable sensors and stimulators enabling adaptive neuromodulation in neurological disorders such as Parkinson's disease and epilepsy; and high-resolution sensing at the cellular and subcellular levels to investigate metabolic pathways and extracellular vesicle-mediated communication. Moreover, novel biosensing architectures will be explored for environmental monitoring, including the detection of hazardous volatile compounds to safeguard "connected" workers operating in hostile environments such as firefighting or mining.

B) Novel Technologies for Personalised Health & Wellness

We are collecting increasing amounts of health data and gaining computing power, yet not fully leveraging it to deliver personalised solutions for today's health challenges like cardiovascular disease, diabetes, and Alzheimer's. Genomics is producing vast molecular data quickly and cost-effectively, opening new research paths while also creating challenges in data volume and analysis speed. To address this, we will use advanced genomic data science, including AI and machine learning, and develop new analytical strategies. Integrating omics data with wearable sensors, clinical records, and other sources will provide a comprehensive view of individuals' health, enabling insights into complex diseases and unmet clinical needs for patient benefit.

We aim to integrate data and knowledge through computational models and digital platforms, supporting personalised treatment strategies. This RC combines large-scale data (from patient records to genomics) with human-centred technology design to address health issues and support healthier, happier lives. INESC TEC's expertise - from Health Informatics and Computational Biology to Bionics and Wearable Technologies - will play a key role.

C) New Challenges in Medical Signal & Image Analysis

Building on two decades of internationally recognised research and development, our objective in this challenge is to address emerging challenges in medical signal and image analysis through the design and implementation of innovative biomedical engineering methodologies. These efforts span several key sub-domains, including cancer image analysis, cardiac image and signal processing, brain imaging, ocular image analysis, and pulmonary image analysis, aiming to advance precision diagnostics and support translational biomedical research.

D) BioRobotics & Human-Machine Symbiosis

Within the biorobotics challenge, we aim at novel and innovative approaches to develop surgery, molecular biology automation, and biologically inspired robots and exoskeletons; to fuse robots with humans "in-the-loop" through brain-computer interfaces (BCIs) and affective computing; to keep biometric algorithms computationally efficient while guaranteeing privacy, transparency, and explainability; to ensure generalisation capabilities to unseen or under-represented types of data by analysing attributes embedded in data to assure veracity and detect incorrect output predictions; and to design and provide representations invariant to the domain of the sample, making results more interpretable.

Featured Contributions in 2025

In 2025, SD BIO had focused on an expansion strategy, helping the involved centres into new contributions in different action vectors, namely:

Infrastructures: In alignment with the SD BIO strategic plan to strengthen research infrastructures, in 2025 we've upgraded the BRAIN-Stim Lab with the installation of a state-of-the-art functional near-infrared spectroscopy (fNIRS) system. This system is fully integrated and synchronised with existing acquisition platforms, including the Micromed 3Dvideo-EEG system and our MRI/fMRI simulator, constructing a comprehensive multimodal neuroimaging and neurophysiological recording environment for advanced neuroscience studies. The upgraded setup enables advanced Brain-Computer Interface (BCI) research by jointly capturing electrophysiological and hemodynamic signals with high temporal and spatial precision. This cutting-edge infrastructure supports the exploration of complex brain dynamics, enhances the study of neural correlates of behaviour and cognition, and provides a reproducible framework adaptable to hospital settings for translational and clinical BCI research.

Publications: Four highlights of our publications of 2025 are worth mentioning:

1. Our publication reporting our research on early MRI biomarkers for identifying the cerebral small vessel disease in its asymptomatic stages triggered by hypertension that impacts the brain's white matter and blood flow regulation was the Editor's Choice for the COVER of Elseviers' scientific journal *Neuroscience* (the official journal of the International Brain Research Organisation (IBRO) - https://doi.org/10.1016/j.neuroscience.2025.06.017).

2. Our paper "Exploring image and skeleton-based action recognition approaches for clinical in-bed classification of simulated epileptic seizure movement" was published at the Top#1 scientific journal in Artificial Intelligence (Google Scholar) - Expert Systems with Applications, from Elsevier.
3. A major landmark was obtained on Computer-Aided Gastric Evaluation research line, with automatic EGGIM estimation reaching clinically relevant results for a single centre, resulting in a total of 10 publications, 2 on them in Endoscopy Journal, which is the leading top journal in gastrointestinal endoscopy, with an impact factor of 12.8. The first paper is focused on using artificial intelligent for endoscopy grading to support risk cancer analysis (https://doi.org/10.1055/s-0045-1805180) and the second on stratification (https://doi.org/10.1055/a-2657-9906).
4. Our paper systematises the current literature on this topic by presenting a comprehensive survey of model compression techniques in biometrics applications, namely quantisation, knowledge distillation and pruning, published in Information Fusion Journal (http://dx.doi.org/10.1016/j.inffus.2024.102657), a top-3 ranked journal in SCOPUS signal processing category.

Patents & IP Creation: Following our leading position at INESC TEC in patent & IP creation from where several spin-offs were "born" such as iLoF.tech, inSignalsNeurotech.ai and Seedsight.io, our patent pipeline is continuing to be filled with 2 new patent applications and 1 internationalisation (RePick technology) during 2025. Additionally, a patent application was submitted in computer vision-implemented method for the detection and classification of urothelial cancer-cells from microscopic cell images (UroVisionNet).

5.3 COMMUNICATIONS

Steering Committee: Luís Pessoa, Manuel Ricardo and Rui Campos

Presentation of the Domain

The Communications Scientific Domain is at the forefront of developing cutting-edge wireless communications technologies that are central to next-generation communication systems. INESC TEC aims to advance communications research across key sectors, including industry, energy, smart cities, mobility, health, the maritime domain, and agriculture. The research group focuses on developing advanced communications solutions tailored to the evolving demands of these fields.

The forthcoming wave of mobile and wireless communications will reshape the landscape through ubiquitous multimodal sensing and localisation, service-oriented software architectures, autonomous systems such as drones and high-altitude platforms, pervasive artificial intelligence, and edge-cloud integration. Building on this, the Communications Scientific Domain has defined the following vision:

"Perceptive and sustainable communication systems integrating ubiquitous sensing"

This vision reflects the domain's ambition to contribute significantly to the wireless communications research, considering the development of technologies that are more adaptable, efficient, and aligned with the needs of an increasingly digital world.

The dual goals of supporting bandwidth-intensive, latency-sensitive applications and bridging the connectivity gap for unconnected machines and humans drive this scientific domain. The core challenge is to develop communication systems that are inherently perceptive and deployable on demand in both terrestrial and non-terrestrial environments. These systems must dynamically adapt to their context by considering the physical environment, energy constraints, communication entities, and the specific needs of users and machines.

Research Challenges

A) Perceptive and Self-adaptive Communications Systems

Next-generation communication systems must be perceptive and self-adaptive, capable of sensing and understanding their environment, and dynamically adjusting their behaviour to meet diverse and evolving operational demands. This includes high-density urban scenarios as well as extreme environments such as deep oceans, outer space, underground facilities, and disaster-stricken areas. The increasing complexity of wireless systems, the proliferation of heterogeneous services, and the need for scalable, secure, and sustainable operation render traditional human-in-the-loop network management unfeasible.

This challenge addresses the development of communication systems that continuously **perceive**, **interpret, and adapt** based on advanced sensing, AI-driven decision-making, and dynamic network architectures. The goal is to design robust, resilient, and intelligent networks that operate effectively in both structured and unpredictable environments, ensuring long-term sustainability, performance, and trustworthiness. Our research focuses on:

- **Perceptive network infrastructures**, integrating mobile autonomous platforms (UAVs, UGVs, AUVs, ASVs) to support adaptive coverage, mobility, and situational awareness in inaccessible or volatile environments;
- **Multi-tier, cross-domain architectures** that seamlessly blend terrestrial, aerial, underwater, underground, and space-based networks, enabling reliable connectivity across heterogeneous and dynamic operational domains;
- **Digital twins of communication networks** to enable fast, flexible, and energy-efficient evaluation of "what-if" scenarios, and the training and validation of adaptive protocols and AI-driven control systems without the burden of resource-intensive real-world experimentation;
- **Context-aware baseband and physical layer adaptability,** enabling resilient, energy-efficient communications using techniques such as geometric and probabilistic constellation shaping, and

supporting multi-standard, multi-mode operation (e.g., radio, optical) under varying environmental and hardware conditions;

- **Multimodal and hybrid communication techniques**, combining acoustic, optical, radio, and free-space quantum technologies to ensure service continuity under diverse propagation conditions and physical media, including underwater environments affected by salinity, turbidity, and acoustic noise;
- **Resource-efficient multimodal RF and sensor perception** using open-source foundation model backbones paired with lightweight adapters. This combination aligns WiFi/5G CSI, radar, LiDAR and other modalities into a shared representation space and explores the general-purpose nature of foundation models;
- **Integrating communication and energy systems**, by developing mechanisms that exploit advances in distributed renewable energy sources and energy flexibility to enable the joint optimisation of communication infrastructure and power distribution, supporting energy-aware and sustainable networking;
- **Security-by-design principles**, including adaptive threat detection (e.g., AI-based intrusion detection in encrypted zero-trust networks) and resilient communication mechanisms across all protocol layers, enhancing trust in self-managed systems.

By advancing in these directions, we aim to help establishing a new generation of communication systems that perceive and adapt in real time – systems that respond intelligently to their environment, anticipate change, and evolve with minimal intervention. To enable such perceptive and sustainable infrastructures, innovation must also extend to the design of reconfigurable, energy-efficient, and multifunctional radio interfaces. These capabilities are essential for building resilient digital infrastructures that can operate across a wide range of challenges, from everyday smart environments to critical and extreme scenarios. These system-level capabilities stand on advances on antenna systems that can intelligently shape and sense the environment.

B) Reconfigurable and Sustainable Antenna Systems

Future wireless networks must rely on advanced antenna technologies that are reconfigurable, adaptive, energy-efficient, and environmentally sustainable. As communication and sensing domains converge – enabled by innovations in millimeter-wave, sub-THz, and optical technologies – antennas are evolving from passive components into programmable, intelligent front-ends that actively shape wireless propagation environments and capture context-rich information.

This challenge addresses the development of antenna-centric solutions that support high-frequency communications, environmental sensing, and green networking outlined in the previous challenge. We aim to build foundational capabilities for intelligent, adaptive, and resource-efficient antenna systems focusing on:

- **Scalable Reconfigurable Intelligent Surfaces (RIS)**, including the design and fabrication of high-frequency RIS hardware operating up to 170 GHz, leveraging PIN diodes, varactors, memristors, and emerging materials such as 2D nanomaterials.
- **Real-time control and beamforming algorithms for RIS, including vision-assisted approaches**, by developing dynamic control mechanisms for RIS-enabled environments, including phase profile optimisation, user-centric beam shaping, and vision-assisted beamforming.
- **Co-design of reconfigurable antenna systems and near-antenna intelligence**, exploring the integration of signal processing and AI capabilities directly into antenna or RIS modules to enable real-time, energy-aware adaptation, including lightweight inference for beam control, sensing, and security.
- **Developing photonics-enabled antenna systems, including radio-over-fiber and optical-wireless interfaces**, to support high-speed, high-resolution RF sensing and ultra-broadband wireless communications;

- **RIS-enabled RF sensing for human activity recognition**, using techniques to enhance RF sensing by dynamically shaping the wireless channel. Through intelligent RIS configuration, spatial diversity is introduced into the channel response, enabling improved classification of human activity using machine learning.
- **RIS-enabled physical-layer security against unauthorised sensing** exploring the use of reconfigurable intelligent surfaces to selectively degrade the ability of external attackers to sense or localise targets in indoor environments, without disrupting legitimate communication.
- **Sustainable antenna design** leveraging eco-conscious materials (e.g., graphene, MoS_2), thin-film electronics, and energy harvesting techniques (solar, RF, piezoelectric) to reduce environmental impact and support autonomous, low-maintenance operation.

By embedding intelligence and reconfigurability into antenna systems, and aligning them with sustainable design goals, we aim to transform the role of antennas in next-generation networks – from static elements to active agents in perception, communications, and environmental awareness. This approach will empower the creation of perceptive, energy-efficient, and resilient wireless systems, supporting applications from smart cities and Industry 5.0 to mission-critical sensing and immersive digital experiences.

Featured Contributions in 2025

In 2025, the Communications Scientific Domain made significant advancements aligned with its two research challenges: Perceptive and Self-adaptive Communications Systems, Reconfigurable and Sustainable Antenna Systems. The results demonstrate progress in autonomous network optimisation, adaptive communications in extreme environments, and the convergence of sensing and communication technologies.

The major contributions include:

- **Blockchain - and Semantic-enabled Underwater Communications**: Improving security and resilience of underwater networks. (OCEANS 2025).
- **Context-Aware Rate Adaptation for Predictable Flying Networks**: Leveraging real-time link context to optimize transmission rates. (IEEE Networking Letters).
- **Efficient Energy-Aware Multi-UAV Placement in Flying Networks**: Ensuring continuous ground user network coverage while minimising propulsion energy consumption. (Wireless Days 2025 and IEEE WONS 2025).
- **Edge-Enabled UAV Swarm Deployment for Rapid Post-Disaster Search and Rescue:** Ensuring both communications and sensing performance by optimising UAV positioning and power allocation. (IEEE VCC 2025).
- **RIS-based IoT Repeater Demonstrator:** A fully integrated Reconfigurable Intelligent Surface (RIS) prototype enabling dynamic beam steering based on real-time indoor localisation data. (IEEE EuCAP 2025).

5.4 COMPUTER SCIENCE AND ENGINEERING

Steering Committee: Ana Alonso, Ana Paiva, Hugo Paredes, João Canas Ferreira and Manuel Barbosa

Presentation of the Domain

The field of computer science and engineering is facing significant scientific and technological challenges, especially in the wake of the ongoing digital transformation, bringing about new and often unforeseen challenges that defy our knowledge and best practices.

These challenges arise from the complexity and scalability of computer and software systems, and the ever-increasing demand for their performance, interoperability, security, privacy, dependability, and sustainability.

Widespread use of digital sensing and instrumentation technologies, coupled with computing power enables us to effectively and efficiently collect, filter, curate, store, process, visualise and analyse the massive volumes of data generated.

We rely on these systems being trustworthy, fast, always available, and ethically responsible, making software development, verification, and testing have become crucial aspects in the critical path of any digital system.

As the computing pipeline is becoming more complex, research on computing architectures and non-functional aspects of software is essential for achieving the scalability, interoperability, and efficiency required for sustainable digital systems.

Research Challenges

A) Advancing the Software Development Ecosystem

Software systems are becoming increasingly complex, with unprecedented scale, integrity requirements and shorter time-to-market. In addition, they are increasingly developed in volatile, uncertain, complex, and ambiguous conditions. It is essential to create new methods, techniques and tools to advance the software development ecosystem, including processes, development tools, and education. This is to be achieved as follows:

- Design tools and techniques to improve developer-tool interaction in next-generation environments.
- Create new approaches to enhance the developer experience, providing quicker, better, and more informative feedback on software quality aspects, easy integration with traditional tools, and suggestions for improvement, including AI-augmented development environments and the engineering of data-driven and learning-enabled software systems.
- Develop techniques to support software maintenance, including automatically generating test cases for novel system parts and calculating impacted test cases based on traceability information.
- Improve software engineering education with didactic approaches and learning tools covering all software development phases.
- Empower people with simpler approaches and tools to design and build applications for personal and professional needs.

B) Ensuring Software Correctness

Functional correctness is one of the key aspects of software quality: ensuring that software is free of defects and does precisely what is supposed to do, and no more (avoiding potential liability gaps). Our goal is to devise new methods and tools to ensure correctness in increasingly complex software systems, namely large-scale concurrent and distributed systems and cyber-physical systems that operate in

uncertain and hostile environments, and emerging computing paradigms, particularly quantum computing. This is to be achieved as follows:

- Design scalable, rigorous methods, calculi, and logic to ensure program correctness throughout software development.
- Improve structured requirements specification languages to reduce ambiguity and automate software development, including repairing incorrect programs and generating invariants for verification.
- Design techniques and tools to enhance software testing in challenging environments, including AI/ML-based systems and leverage HPC, probabilistic systems, and hybrid verification approaches combining formal and empirical methods.
- Contribute to innovative concurrent programming languages, APIs, and compilers for parallel and distributed computing, raising abstraction levels.
- Improve formal design techniques and tools for scalability and usability, enabling direct verification of complex protocols by domain experts.
- Integrate rigorous formal analysis and user-centred design practices for formally proving requirements and evaluating prototypes.
- Create foundations for emerging computing paradigms, including quantum computing, quantum software engineering, post-quantum secure systems, and cyber-physical systems.

C) Managing the Increasing Complexity of Critical Information Systems

Information production and consumption profoundly impact society, both personally and professionally. Two key challenges arise from information abundance: managing complexity and ensuring information quality and relevance.

Managing complexity involves managing the underlying infrastructure supporting information, such as storage, processing, and distribution. Ensuring these systems handle large volumes efficiently is crucial.

At the infrastructure level, size, diversity of software and services, multiple data sources, and compliance with laws and regulations contribute to complexity, including federated data spaces and privacy-preserving data processing infrastructures supporting cross-organisational collaboration. Non-functional system characteristics, such as scalability, performance, interoperability, dependability, security, energy efficiency, information quality, quantity, and confidentiality, play a crucial role in ensuring trustworthiness and sustainability.

Accessing and managing information quality and relevance is another challenge. Finding specific data or content maximises productivity, while ensuring high-quality and relevant information is especially difficult in the era of fake news and misinformation.

Providing the best balance for each application or service requires a deep understanding of variables and composable multidisciplinary approaches. We envision the continued need to focus on improving:

<u>The non-functional aspects of data management systems and infrastructures on:</u>

- Heterogeneous data management and cross-sector applications on public and private infrastructures, such as cloud computing and HPC centres, while realising their interoperability and enabling control of the information life cycle.
- Data management systems underpinning data-centric and privacy-preserving applications such as machine learning, analytical, and database frameworks.
- Systems of the Edge-to-Cloud continuum and cyber-physical systems as these systems evolve towards distributed and virtualised architectures.
- Standard cluster management and task scheduling tools to prioritise energy efficiency in Cloud and HPC centres.

Information management through:

- Representation models, information governance frameworks and policies, until the level of global communities.
- Information life-cycle control in organisations by enhancing the authenticity and traceability of data provenance.
- Tools to support the different stages in the data management process, along with interoperability protocols.

Access to information through:

- Studies of users' information needs and their interactions with information systems, by contributing to relevance estimation algorithms, ranking algorithms, and the development of novel mechanisms for human information interaction.
- Increasing the efficiency and effectiveness of visual analysis and exploratory visualisation of complex and multidimensional information.
- Ameliorate the communication of complex narratives, through information extraction and representation techniques, and interactive visual storytelling models.

D) Designing and Deploying Heterogeneous Computing Architectures

Processor architectures shifted from single-core to multi- and many-core, including heterogeneous accelerators like ASICs and FPGAs. Flexibility shifted from software to hardware. However, new applications on the edge and IoT, including AI and ML, require end-to-end optimisation across the edge-to-cloud continuum for data-intensive and AI-driven workloads, stricter time constraints and power efficiency.

As performance requirements increase, heterogeneous systems offer a way to achieve it while minimising power consumption and cost. They allow hardware to be tailored to specific applications, meeting their demands and enabling software to effectively utilise it.

Designing these novel computing systems involves considering the holistic vertical continuum of hardware and software. Challenges include increased complexity, high-performance requirements on autonomous systems, dependability, and cybersecurity, spanning from digital components to instruction sets, compilers, languages, and APIs.

Within this hardware-software continuum, we focus on:

- Developing bio-inspired mixed-signal microelectronic circuits to improve power and area efficiency through event-driven computational architectures.
- Designing heterogeneous hardware platforms: methods and tools for design space exploration of accelerators, to optimise performance, power consumption, and area.
- Integrating CPUs with application-specific accelerators: this involves addressing challenges in interface design, memory hierarchy, coherence and consistency, programming model, and performance optimisation.
- Devising novel compilation techniques to decrease the effort of scheduling and mapping computations to heterogeneous targets.
- Improving performance and predictability of computing systems, by appropriate management of HW and SW resources and components, including models for prediction of performance and energy efficiency of a heterogeneous application at design time.

E) Improving Computational Systems for a better Human-Technology Symbiosis

Humans and machines increasingly collaborate by sharing information, goals, and tasks, empowering and complementing each other.

Digital environments, combining immersion, collaboration, interaction, and narrative, provide rich and engaging experiences for users in learning, entertainment, workplaces, and industry. This includes the development of human-centred AI systems and digital twin environments that integrate data, simulation, and human decision-making processes.

The goal is to improve human-machine relationships by combining data, operations, processes, and awareness. It is focused on:

- Empowering humans with contextual awareness in increasingly complex extended reality systems, for areas such as education & training, information analysis, exploratory visual analysis, and decision-making processes.
- Integrating effective user-centred and co-creation design practices in computational systems and tools, to increase their effectiveness, adoption, and impact.
- Empowering domain and human-factors experts in the use of state-of-the-art model-based tools for automated verification, in the context of safety-critical system, enabling them to model systems, define safety requirements, perform analysis and interpret the results.
- Empowering non-technical people in authoring activities, incorporating new interaction paradigms, supported by extended reality, natural user interfaces, new AI tools, and multimodal systems, enabling them to design and build personalised solutions.
- Leveraging multisensory stimulation and haptics to attain perceptually equivalent scenarios for extended reality systems.
- Reinventing symbiotic processes for learning, work, and well-being in digital environments, including serious games, gamification, and extended reality, optimising user experience.

Featured Contributions in 2025

Advancing the Software Development Ecosystem

Research advanced the engineering of next-generation software systems, particularly in AI-enabled, distributed, and privacy-preserving environments. Within the Inno4Vac (IMI2/EU) and NOUS projects, contributions included the design and implementation of federated repositories and privacy-preserving mechanisms supporting distributed machine learning, as well as the integration of human oversight into automated data standardisation processes.

Progress was also achieved in developer productivity and system evolution through research on Developer Experience, microservice architectures, and LLM-based system engineering, culminating in PhD-level contributions. In parallel, advances in program analysis and transformation enabled automatic compliance with standards such as MISRA-C, as well as support for heterogeneous programming ecosystems (including C, Fortran, and ONNX-based AI models), reducing development effort while improving reliability and portability.

Ensuring Software Correctness

Significant advances were achieved in formal methods and high-assurance systems, targeting distributed, data-intensive, and quantum-enabled environments. The CRDV model for conflict-free replicated data views, published at SIGMOD 2025, enables scalable and consistent data management in distributed systems, while new approaches to quantum benchmarking and optimisation, published in Quantum Science and Technology, improve the efficiency and evaluation of quantum algorithms.

Complementary contributions include the development of secure genomic computation tools such as Gyosa, enabling privacy-preserving analytics in cloud environments, and advances in concurrency correctness through property-based testing frameworks capable of detecting errors in lock-free data structures. Additionally, compile-time techniques for memory safety in C were developed, enabling detection of issues such as dangling pointers.

These results address fundamental uncertainty in ensuring correctness at scale, particularly in emerging computing paradigms.

Managing the Increasing Complexity of Critical Information Systems

Research addressed the complexity of large-scale, data-centric infrastructures through advances in distributed, privacy-preserving, and trustworthy information systems. Within the PRIVATEER Horizon Europe project, the development of a Distributed Shared Index (DSI) enabled resilient cyber threat intelligence sharing by eliminating single points of failure and improving system performance under adversarial conditions.

Progress was also made in privacy-preserving data processing, including novel methods for synthetic time-series generation based on multilayer graph representations, as well as in the design of FAIR-compliant data infrastructures supporting large-scale federated health systems, such as IMPROVE PRETERM and Health from Portugal.

In parallel, advances in information quality and access were achieved through domain-adapted NLP pipelines, including LLM adaptation to specialised corpora (e.g., military datasets), disinformation detection models incorporating emotional and temporal dynamics, and the development of large-scale multimodal datasets and information extraction frameworks.

Designing and Deploying Heterogeneous Computing Architectures

The domain achieved advances in heterogeneous and high-performance computing across the hardware–software continuum. Contributions include the development of RISC-V-based platforms and co-simulation frameworks enabling integration of AI accelerators with full-system validation, as well as novel compilation techniques supporting automatic mapping of complex workloads, including large language models, to hardware accelerators.

Research also addressed resource management and performance optimisation in heterogeneous environments, including scheduling strategies across multi-core CPUs and GPUs. At the systems level, innovations include reconfigurable intelligent surface (RIS) prototypes for adaptive wireless environments and edge-enabled distributed systems for applications such as UAV-based communications and post-disaster scenarios.

These contributions tackle key challenges in performance, energy efficiency, and programmability in next-generation computing systems.

Improving Computational Systems for a better Human-Technology Symbiosis

Research advanced human-centred computing through the integration of AI, immersive technologies, and interactive systems. Within projects such as BLUE-X and Battleverse, extended reality and digital twin platforms were developed to support decision-making in complex domains, integrating heterogeneous data sources and simulation models to enhance situational awareness.

Progress was also achieved in human-in-the-loop AI systems and AI-mediated education, including LLM-based tools for self-regulated learning, cognitive ecosystem approaches to digital education, and personalised dashboards for decision support (e.g., FRODDO project). Additional contributions include multimodal emotion analysis and interactive media systems developed in projects such as EADIGIFOLK.

These results reinforce the role of computational systems in augmenting human capabilities, addressing challenges in usability, trust, and cognitive integration in complex digital environments.

5.5 POWER AND ENERGY SYSTEMS

Steering Committee: Clara Gouveia, João Peças Lopes and Ricardo Bessa

Presentation of the Domain

The Power and Energy Systems Scientific Domain envision supporting society's full and enduring decarbonisation by adopting a multidisciplinary strategy that acts on the whole energy value chain by planning and operating it across multiple energy carriers, infrastructures, and users in an integrated, interconnected, and digitalised energy ecosystem. This will be anchored on combining model-based and data-driven methods for modelling, optimising, and controlling energy systems while proposing novel policy and regulatory solutions. Research outcomes include concepts, models, methodologies, and tools helpful in addressing the decision problems of citizens, communities, multi-utilities, system operators, regulators, policymakers, and government bodies, divided into four research lines: 1) Cost-effective decarbonisation and digitalisation of energy systems. 2) Evolving and de-centralising energy-driven business models and markets. 3) Resilience and reliability of energy systems. 4) Smart control architectures and centres of the future.

Research Challenges

A) Cost-effective decarbonisation and digitalisation of energy systems

An efficient and sustainable energy system is crucial to achieving global climate targets and a sustainable future, as it provides critical services such as electricity, heating/cooling, and transportation. Renewable energy systems can generate carbon-free hydrogen and ammonia, which are critical to decarbonise other economic sectors such as mobility (e.g., H2 utilisation in fuel cells) and industry (e.g., NH3 utilisation in the chemical industry). Digital technologies should be integrated into the operation and planning of energy systems to further increase the integration of clean energy sources, towards 100% renewable energy-based systems. This will support the development of new mathematical models for emerging technologies such as electrolysers and thermal storage, and novel methods to optimise the integrated management of multiple energy networks and vectors.

The main goal regards the development of new models, methods, and tools to: 1) Optimise the operation of electrolysers to maximise the use of renewables and provide system services. 2) Develop advanced control solutions to manage natural gas networks when incorporating renewable gases (biogas and H2). 3) Enable the implementation of P2P solutions associated with seasonal energy storage to guarantee security of supply. 4) Improve the integrated management and control of multiple energy networks, considering high shares of renewable electricity and gas production (in electricity and gas networks, respectively). 5) Aggregate multi-vector resources' flexibility for optimal participation in electricity, gas, and carbon markets. 6) Design and operate 100% renewable systems for green hydrogen and ammonia production. 7) Implement reference architectures to facilitate secure data sharing in the energy sector – energy data spaces. 8) Design and develop interoperability frameworks that rely on open standards to ensure the compatibility of equipment and systems, while safeguarding the privacy and cybersecurity of users.

B) Evolving and de-centralising energy-driven business models and markets

Electricity markets have proven to be effective tools to improve the efficiency in the production and pricing of electricity commodities such as energy, flexibility, and capacity, while providing appropriate economic signals to consumers and producers to induce them to adapt their short- and long-term behaviours to existing and expected demand and supply.

As we face a shift towards distributed and decentralised energy systems, new technical and market challenges arise, namely: 1) Redesign and regulate wholesale electricity markets to integrate new resources and market players and assess their impact. 2) Develop and regulate new business models and local markets for collective self-consumption and energy communities, seamlessly integrated into existing wholesale markets and capable of fostering decentralised electricity trading and local renewable generation to empower end-customers in the energy system. 3) Unlock existing distributed flexibility to contribute to a better operation of the electricity system through more flexible and near real-time resource management systems and markets.

C) Resilience and reliability of energy systems

Transitioning from fossil fuels to sustainable energy sources amid climate change can create vulnerabilities to severe weather events, leading to energy shortages and damage to existing infrastructure. Conversely, digitalisation of power systems presents new opportunities to enhance system reliability and resilience by developing planning and operation plans based on forecasts, real-time monitoring and control, and predictive maintenance strategies. By leveraging all these opportunities, power systems can become more efficient, reliable, and resilient, ensuring a stable and sustainable supply of electricity for consumers.

The envisioned research challenges are: 1) Develop models and tools for the assessment of the long-term adequacy of interconnected systems under climate change and extreme weather affecting bulk energy consumption. 2) Develop methodologies for establishing reliable and resilient expansion plans for coupled energy networks (electricity and gas) in converter-dominated systems. 3) Analyse the ability of the existing flexibilities in local energy grids for improving the continuity of supply during contingency events. 4) Leverage data-driven models to monitor the asset condition and to define optimal maintenance plans.

D) Smart control architectures and centres of the future

Electrical networks are undergoing transformation as ongoing decarbonisation and digitalisation introduce new assets and devices (e.g., PMUs, IEDs). These changes directly impact the control centres and architectures of power systems, requiring greater interaction with neighbouring transmission systems, the integration of weather-based energy resources, new market products, active distribution networks, microgrids, and wider data availability. Supervision systems in control rooms have grown unreasonably to remain cognitively manageable, and the redesign of human-machine interactions becomes necessary.

The envisioned research challenges are: 1) Promote coordinated operation between electricity markets, TSO, and DSO, within an increasingly complex network and market operation context. 2) Assist human operators via a proactive collaboration in robustly operating the flows over a power grid, avoiding blackouts because of overloads, while minimising energy losses, as well as the operator's cognitive load. 3) Structure the decision-making process, and design it explicitly for making decisions over tasks and not for monitoring (i.e., to avoid operating systems with information overload). 4) Let human operators become "navigators", defining forecasted trajectories over time and choosing options ahead of time rather than reacting in real-time. 5) Distributed and decentralised protection, automation and control, benefiting from virtualisation and distributed computation at the edge.

Featured Contributions in 2025

Cost-effective decarbonisation and digitalisation of energy systems

Research advanced the integration of low-carbon technologies through power electronics, optimisation, and data-driven energy management. A power converter and control system enabled hydrogen electrolysers to provide ancillary services, including FCR and FFR, experimentally validated in a PHIL setup and published in Int. J. Hydrog. Energy. Comparative studies of active AC/DC rectifier topologies for green hydrogen production were presented at IEEE VPPC 2025. Control schemes for low-voltage ride-through and reactive power provision through an AC/DC/DC chain were developed; results were presented at IEEE PowerTech 2025, and the solution supported a patent application.

At the system level, optimisation methods assessed hydrogen as a flexibility option for offshore hybrid energy systems and proposed a framework to increase renewable integration while respecting cable constraints (Sustain. Energy Grids Netw.; Appl. Energy).

Electrification of mobility advanced through an explainable carbon-aware framework for EV charging and emission-budget management under uncertainty (Appl. Energy). Complementary work addressed battery degradation through data-driven charging strategies (IEEE Access). A related patent submission described a mixed-integer optimisation method for coordinated fleet charging, PV and battery dispatch, and charger allocation.

Decarbonisation of maritime ports was addressed through physics-based models for electrified loads in container terminals, including cranes, refrigerated containers, and onshore power supply. These models supported demand response through reefer thermal inertia, electricity-price-aware crane scheduling (EPIA

2025), and peak shaving for OPS (EFEA 2025). They were integrated into a discrete-event multi-agent simulator, providing a sandbox to test decarbonisation strategies without scarce industrial data. Policy contributions included participation in a Portuguese roadmap for OPS deployment and work on load forecasting in port decarbonisation (Transport Policy). Additional studies showed that a 5 °C temperature variation can change hydrogen injection limits in gas networks by about 5.9 % (Sustain. Energy Grids Netw.).

Evolving and de-centralising energy-driven business models and markets

Research also addressed market design and regulation for decentralised energy systems. Within BeFlexible, a grid segmentation service was developed to support DSOs in defining operational zones using historical data. Building on this, a framework for local flexibility markets was proposed in which market clearing and resource aggregation are grid-aware while preserving the confidentiality of detailed topology information. The methodology enables zonal flexibility procurement and was published in Utilities Policy.

Market design research was extended to integrated electricity and hydrogen markets. The HERO academic model was upgraded to include contract modelling for both commodities and to analyse market outcomes under perfect and Cournot competition. An equivalent formulation for Cournot equilibrium simplified computation and improved maintainability (Int. J. Hydrog. Energy).

Research on energy communities analysed regulatory frameworks for self-consumption and local energy markets and proposed targeted improvements (Renew. Sustain. Energy Rev.; Heliyon; EEM 2025). Studies on Renewable Energy Communities explored optimisation strategies to maximise self-consumption, reduce grid imports and surplus injection, and assess CO2 savings and energy costs. Complementary work proposed pricing and benefit-sharing mechanisms ensuring fairness between host and non-host members, including allocation methods based on Shapley values, marginal contributions, and system marginal costs.

Resilience and reliability of energy systems

A further pillar concerned resilience and reliability in converter-dominated systems. Methods were developed to size grid-forming converters for autonomous black start of isolated offshore wind farms in future energy-island configurations (Sustain. Energy Grids Netw.). Additional work proposed optimisation approaches for placement of grid-forming converters using multiple stability indices within a unified heuristic framework, and a bi-level method that jointly optimises placement and sizing through Bayesian optimisation and gradient-based methods (IET Gener. Transm. Distrib.; Int. J. Electr. Power Energy Syst.).

Reliability analysis of hybrid AC/DC distribution networks advanced within HYNET, where a stochastic framework for systems with multi-terminal DC links enabled accelerated Monte Carlo simulation and reliability equivalencing, while a probabilistic methodology for Quality-of-Service indices was presented at EEM 2025. Cyber-resilience studies modelled UAV-based cyberattacks on microgrids and proposed mitigation strategies (IEEE Trans. Ind. Appl.).

Smart control architectures and centres of the future

Research on future control architectures focused on combining AI with power-system operation. An interdisciplinary collaboration examined human-AI interaction in safety-critical infrastructures, including power grids, railway networks, and air-traffic management (iScience).

AI-assisted methods were developed for the automatic design and tuning of controllers, enabling dynamic models for system-level simulations (Sustain. Energy Grids Netw.). For low-voltage grids, data-driven techniques improved observability and modelling accuracy, including topology reconstruction using genetic algorithms and phase identification using Mahalanobis-Wasserstein similarity metrics, presented at IEEE SMC 2025. A complementary algorithm exploiting the low-rank structure of sensitivity matrices was developed to correct measurement-induced errors and submitted to the IEEE Trans. Power Syst.

Advanced protection, automation, and control applications were developed for medium-voltage distribution networks. An adaptive protection scheme combines operating-regime clustering, EPSO-based settings optimisation, SVM-based decision support, and anomaly detection using variational autoencoders. Results were presented at IEEE PowerTech 2025. Finally, AI-based operational intelligence for distribution grids was strengthened through fault location, adaptive protection automation, and resilience-oriented risk assessment, reported in ISGT-Europe 2025, IEEE PowerTech 2025, and IREP / Sustain. Energy Grids Netw.

5.6 PHOTONICS

Steering Committee: Diana Viegas, Nuno Silva and Pedro Jorge

Presentation of the Domain

The Photonics Scientific Domain explores optical phenomena as a unique toolbox for cutting-edge science and technology, exploiting symbiotic S&T for a sustainable research model. Fundamental research, on the one hand, gives rise to novel sensing systems and inventive technology. On the other hand, using emerging technology to enable innovation in real-world applications, materialising the impact of science, and diversifying funding opportunities. This generic vision has materialised in the three major research vectors:

1. Development of sensors for chemical sensing and industrial applications;
2. Photonic sensing for extreme environments;
3. Optical systems and devices for ultra-fast processing and quantum technologies.

Adding to S&T, the domain is also committed to the development and training of a new generation of highly specialised researchers with a unique set of competencies and critical knowledge to foster a national research and industrial ecosystem emerging around photonics.

Research Challenges

A) Enabling Resilient and Reliable Photonics-Based solutions for biological and chemical sensing

To meet the required performance in demanding and continuous real-world operation scenarios, the next generation of photonic sensors must be not only highly sensitive but also resilient, being capable of long-term operation without degradation, presenting high reliability, and providing accurate and trustworthy insights under diverse and challenging conditions. This need is particularly pressing for biological and chemical sensing applications, where issues such as sensor drift, biofouling, and cross-sensitivity to environmental factors (e.g. temperature, pH, or salinity) can significantly reduce signal fidelity, lead to false alarms, and ultimately compromise critical decisions. To address this challenge, our team leverages cutting-edge expertise in optical sensing and microfabrication to establish a comprehensive approach that spans the full sensing pipeline: transduction, integration, and interrogation. This multi-pronged strategy ensures each stage contributes to the development of robust, high-performance sensing systems suited for continuous and reliable operation in real-world settings. In specific, our medium term focus is set on the development of sensing devices and systems with the following features: better than present day standard accuracy, scalability, ease of use, miniaturisation, operational speed, and long-term reliability.

B) Monitoring Extreme Environments with Remote and Distributed Optical Sensing

Understanding and monitoring dynamic and complex systems is of crucial importance for informed decision and policymaking. Yet, extreme environments such as the ocean present specific monitoring challenges. They involve wide spatial and temporal scales that complicate system architecture and deployment, including the need for reliable long-distance delivery of both power and data. At the same time, harsh conditions like corrosion, high pressure, and mechanical stress threaten sensor integrity, while seawater's chemical complexity complicates analytical accuracy and stability. In this context, we seek to enable light-based monitoring solutions capable of operating in extreme and demanding environments (from ocean to space and critical infrastructures), including fiber-based sensors (from FBGs to SOP and Distributed Acoustic Sensing) and multiscale and sensor fusion approaches. The operational commitment of this challenge is to deliver till 2030, at least one validated monitoring demonstrator integrating fiber-based sensing, complementary imaging technologies, and advanced data fusion, deployed in a relevant extreme environment scenario such as offshore energy or ocean monitoring.

C) Harnessing Optical Devices and Quantum Technologies for Sensing, Imaging, and Computing

Light is the fastest, most versatile information carrier we know, being able to travel immense distances with minimal loss, and encode data simultaneously in amplitude, phase, polarisation, and even orbital angular

momentum. Yet, to achieve all-optical data processing and control its properties to increase signal-to-noise ratio specifically when entering the quantum regime - where extreme sensitivity and unique versatility compete with higher noise levels on the detection side - requires significant work on the fundamental research side. In this challenge, we aim to explore the use of light as a multipurpose channel to encode, probe, and process information, leveraging wavefront control, interference, nonlinear, and quantum effects as information processing elements. We commit to a fundamental research path that spans two directions – ultra-fast physical computing, and quantum sensing and imaging technologies - intertwined in the needed competencies and technologies, with the aim to achieve high-profile scientific results in the topic of quantum technologies (simulation and imaging), capable to position the institute as a key player on the topic and support successful internationalisation efforts on the context of Horizon Europe Pillar I.

D) Enhancing decision tools through Multimodal Spectroscopy Instrumentation

Growing sustainability demands, resource scarcity, and the need for more circular production models create persistent challenges for the industry in accessing high-performance solutions capable of reliably identifying and characterising materials across sectors such as raw materials processing, manufacturing and recycling. While spectroscopy is already an established and valuable tool in industrial settings, important gaps remain in delivering fully integrated, robust, and real-time systems suited to demanding production environments. In this research challenge, our focus is to address these needs by developing science-driven, fit-for-purpose tools that deliver actionable insights and enable advanced decision-making to improve sorting processes, quality control, and environmental impact assessments. Building on recent advances in instrumentation and interpretable AI-based signal processing and analysis, our team has already demonstrated solutions capable of tackling real industrial sorting challenges, including mineral identification in mining, detection of refractories in glass recycling, and characterisation of recycled wood. This challenge seeks to further develop these capabilities into a robust, flexible, and integrated multimodal approach, along the multiple directions from spectral imaging hardware to data processing and integration, aiming to deploy at least one multimodal material characterisation demonstrator in an industrial setting by 2030, supporting automation, digital twins, and advanced decision-making.

Featured Contributions in 2025

In 2025, the Photonics Domain achieved major advances across the 4 research challenges, consolidating its position in both scientific excellence and technology transfer, and strengthening the development of sensing solutions for environmental and industrial applications.

Starting with the first research challenge, significant progress was achieved in nanotechnology and integrated photonics, from simulation tools to high-quality structure fabrication (e.g. photonic crystals, plasmonic structures, optical filters). These developments were complemented by results in femtosecond-assisted two-photon absorption lithography and direct laser writing, including low-loss waveguides (multi-pass writing and thermal annealing), and thermal phase shifters (metal laser ablation). An optofluidic platform based on femtosecond micromachining of glass capillaries was also demonstrated, resulting in an international patent filing (EP24213413) with application potential for local industry and partners (e.g. iLOF). In parallel, regarding biological and chemical sensing, new optical and optoelectrochemical methodologies were validated for structural health monitoring, environmental sensing, and industrial deployment, including concrete curing (P2011.4, EP25218932.9), autonomous algae and chemical reaction chamber monitoring (P2004.4), and hydrogen and methane sensing systems (P1989.0, EP 25175553.4, P2001.3, EP 25191371.1), all with promising future industrial applications.

Moving to the second research challenge, extensive trials with distributed sensing approaches were carried out on submarine and suspended OPGW cables, confirming the maturity and versatility of fibre-based monitoring technologies. For submarine cables, DAS was benchmarked against OBS systems, showing equivalent performance and validating DAS as a reliable alternative to conventional approaches, highlighting vessel-signature detection algorithms for real-time vessel identification within the Submerse project. In parallel, sensing capabilities of OPGW cables were also extended to the detection of transmission towers and bird nests, demonstrating strong potential for critical infrastructure monitoring and biodiversity-related observation to be explored in short-term.

The third research challenge was also punctuated by significant advances in quantum technologies, with highlight to the development of a Hong-Ou-Mandel microscopy setup that harnesses non-classical states

of light to perform polarisation imaging (10.48550/arXiv.2512.19637). Working at ultra-low intensities (single photon regime), this unique quantum technology offers promising potential for samples susceptible to photo-damaging. In optical computing and information processing, Fisher-information-enhanced sensing strategies (10.1364/OL.570619) and speckle-based multipoint acoustic sensing solutions (10.48550/arXiv.2509.22094) establish promising new research directions that will support in the short-term to the development of all-optical platforms for edge computing and ultra-fast sensor interrogation.

Finally, significant advances at the application-level were also achieved on the fourth research challenge, with the development of an industry-grade LIBS prototype for contaminant identification in recycled wood under PRR TRANSFORM (10.1016/j.jhazmat.2025.137493) and new algorithms for user-centric analysis of multimodal spectral data. Besides, consolidating the strong emphasis on knowledge transfer of this research challenge, an INESC TEC spin-off PROSPEC won the EIT Jumpstarter 2025 (Raw Materials cohort), setting an interesting medium-term outlook aligned with the commitment of continuous development of the local industry ecosystem.

These scientific achievements were matched by strong innovation output in 2025, including software for vessel detection, advances in FanoiFBG technology, new solutions mitigating Vernier-effect limitations, a patented speckle-based multipoint sensing approach, and a substantial portfolio of patent applications spanning gas sensing, structural health monitoring, optoelectrochemical devices, and optofluidic technologies. Besides, in terms of funding attraction and strategic positioning, we shall highlight an increasing number of submissions and successful proposals on the topics of advanced optical systems for ultra-sensitive detection of water contaminants and distributed sensing, and an emerging effort in leading applications at European level with a submission with South Korean institutes in quantum technology and in underwater research.

5.7 ROBOTICS

Steering Committee: António Paulo Moreira, Bruno Ferreira and Eduardo Silva

Presentation of the Domain

The Robotics Scientific Domain is at the forefront of developing real multi-domain robotics. It combines intelligence, autonomy, and usefulness seamlessly across various uses on land, in the air, on the water, and underwater.

The focus on advancing autonomy is central, specifically empowering robots to operate effectively in complex and dynamic environments across multiple domains. This involves creating and maintaining intricate environmental maps, reacting swiftly to unforeseen events, and enabling unattended operations over extended periods.

The increasing interaction between people and robots is equally significant in all areas. INESC TEC's robotics research seeks to transform programming and communication interfaces, enhancing the simplicity and availability of assigning tasks to robots for operators from diverse backgrounds, regardless of the operational domain.

In each target domain, researchers at INESC TEC investigate new types of robotic action that go beyond conventional limitations. By doing so, they introduce innovative solutions tailored to the unique challenges of ground, air, water, and undersea applications. This interrelated investigation pushes the limits of conventional applications in each discipline and broadens the scope of what robotics is capable of.

Research Challenges

A) Increase the autonomy of robotic systems

In 2025, advancing the autonomy of robotic systems remained central to our research agenda, driven by the need to operate reliably in complex, dynamic, and long duration scenarios. Our work addressed the full sense–perceive–plan–act cycle, with a particular focus on improving positioning and navigation in environments where GNSS is unavailable or unreliable. Efforts targeted the development of novel landmark-based localisation methods, seamless switching between global and local reference frames, and resilient navigation frameworks capable of managing uncertainty in real time.

Robotic systems operating in complex, dynamic, and long-term environments require greater autonomy, achievable by addressing all stages of the sense-perceive-plan-act cycle. Key challenges to enhance autonomy include:

- Improving positioning in GNSS-denied environments using novel landmarks and algorithms.
- Developing navigation methods that enable seamless switching between global and local localisation.
- Creating robust distributed SLAM strategies that handle communication delays and failures.
- Planning trajectories for active perception and adaptive sampling in single or multi-robot setups.
- Designing fast optimisation and task allocation algorithms for real-time, dynamic scenarios.
- Proposing scalable mapping strategies for extended missions and environments, with single or multi-robot teams.
- Equipping robots with failsafe and degraded mode operation capabilities for subsystem failures.
- Developing AI-based semantic perception and reasoning methods, including VLMs, LLMs, and generative models, to support long-horizon autonomy, adaptive planning, and failure recovery in complex environments, including remanufacturing and disassembly tasks.

B) Improve manipulation and other physical interaction capabilities

We aim to advance robotic manipulation and physical interaction with the environment across three key areas: final relative positioning (e.g., docking), manipulation of semi-rigid flexible objects, and mobile manipulators.

- For positioning, challenges include trajectory planning that ensures target observability and respects pose/DoF constraints and actuator control under dynamic physical constraints.
- For flexible object manipulation challenges are: perception – new models/algorithms for shape variability; grasping – integrating deformation models into planning and control; and assembly – path planning that avoids entanglements via deformation modelling.
- For mobile manipulators challenges are: coordinated base and end-effector control; systems to reject terrain disturbances; and control of actuators on floating/underwater platforms.

C) Enhance human-robot collaboration

Recent advancements enable autonomous robotic tasks, but human involvement introduces unpredictability due to factors like mental models, emotions, and perception. This challenge focuses on developing algorithms and tools for dynamic, collaborative human-robot interaction.

- Key topics include: real-time human action and posture recognition to enhance safe, natural collaboration; methods for transparent, explainable robot behaviour using technologies like AR/VR and advanced human-computer interfaces; and algorithms that integrate human knowledge and skills through high-level programming, teleoperation, and shared control.

D) Design sustainable robotic systems

This challenge focuses on designing advanced robotic systems that overcome the limits of standard platforms. Sustainable development of robots capable of deeper operation, diverse tasks, or large-scale deployment relies on three key areas:

Modular and reconfigurable robots – Developing systems that are easy to set up or self-reconfigurable, integrating mechanical, electrical, communication, and software components for impactful modularity.

Robotics software development – Developing trustworthy and efficient architectures for deploying foundation-model-based robotic intelligence, including edge/cloud execution, runtime monitoring, digital twins, and synthetic data generation.

New platforms and companion systems – Advancing current platforms for extreme environments, designing novel robots (e.g., legged, cable), and developing specialised devices like agricultural end-effectors or advanced docking stations.

Featured Contributions in 2025

Selected contributions aligned with the challenge increased autonomy of robotic systems are the following:

A) Increase the autonomy of robotic systems

- Advanced Algorithms for Fleet Coordination: New fleet management developments focus on optimised trajectory decomposition, multi-threaded performance boosts, refined footprint detection, and validated simulations for high-density fleets (+100 AMRs);
- AI-based techniques to extend the navigation capabilities of Autonomous Mobile Robots (AMRs). These works leveraged the potential of Artificial Intelligence to optimize complex processes regarding localisation, control, and task allocation. Specific contributions include the use of LLM-based Chatbots for Task scheduling in Robot Operations, DRL for LiDAR-Only Robot Navigation in Simulated Hallways.

B) Improve manipulation and other physical interaction capabilities

- Innovative algorithmic methods for robotic perception and manipulation in complex recycling and disassembly scenarios were developed in 2025. The work focused on autonomous handling, detection and classification of heterogeneous components in unstructured material streams, including objects with variable geometry, occlusions, and fastening elements (textiles). In parallel, advanced approaches were developed for automated disassembly, combining deep learning-based perception with decision-making and robotic manipulation. High-performance methods for screw detection, tool recommendation, and task execution planning enabled robots to perform unscrewing operations with high accuracy and limited human intervention.

C) Enhance human-robot collaboration

- 5G based Modular teleoperation system specifically designed for mobile robot fleets. This system enables the remote control and supervision of multiple mobile robots, allowing operators to manage distinct robotic platforms across complex industrial environments. The architecture consists of robot-side units, which provide plug-and-play video capture, hardware encoding, and real-time streaming independent of the host platform. A central server orchestrates robot-operator pairing and connection establishment, while operator stations facilitate the direct supervision of all connected robots. Teleoperation is conducted through a virtual reality (VR) environment that enhances operator immersion, depth perception, and situational awareness. By utilising peer-to-peer WebRTC streaming and direct MQTT robot control, the system achieves low-latency operation, ensuring rapid and efficient response times. Furthermore, the use of 5G connectivity enables reliable communication, even in remote locations, while the system's hardware-agnostic design ensures scalability and seamless integration with different robotic platforms.
- XR-based teaching framework, which enabled human operators to demonstrate manipulation tasks to robots using Extended Reality (XR) headsets. These demonstrations, captured in real time, provided the data necessary to train robots through behavior cloning algorithms, allowing them to replicate human actions autonomously. This method significantly reduced the need for manual programming, enabling robots to adapt to variations in object placement and task conditions.

D) Design sustainable robotic systems

- Advance the integration of Generative AI, Large Language Models (LLMs), and Vision-Language Models (VLMs) into Digital Twin infrastructures for industrial robotics. The framework enables automated recognition, localisation, and persistent virtual representation of objects in complex industrial environments, ensuring Digital Twins remain accurate and continuously updated in response to real-world changes. This approach substantially improves traceability, situational awareness, and system-level optimisation. The outcomes of this work led to the submission of a patent application, currently pending, covering the core methods for AI-driven recognition, localisation, and virtual representation of multiple objects.

- Research on the Modular E and Modular X platforms advanced robotic solutions for precision agriculture and forestry through the development of dedicated prototypes for vineyard phenotyping and automated selective thinning in eucalyptus forests. Modular-E was equipped with a multi modal sensing module and a lightweight articulated manipulator, enabling close-range, high-precision phenotyping under real field conditions. In parallel, the ASSeT prototype, built on Modular-X, integrated a cost-effective robotic manipulator with a precision cutting tool to autonomously identify, select, and remove competing stems in young eucalyptus stands. Field trials demonstrated the effectiveness of both systems in complex outdoor environments, showing improved measurement accuracy, reliable perception and manipulation, and enhanced support for data-driven crop and forest management through the integration of AI, advanced sensing, and autonomous navigation.

5.8 SYSTEMS ENGINEERING AND MANAGEMENT

Steering Committee: António Lucas Soares, Beatriz Brito Oliveira, José Coelho Rodrigues and Lia Patrício

Presentation of the Domain

Systems engineering and management research seeks to advance the design, implementation, and improvement of systems for decision support, human-centred operations, intelligence, technology management, and innovation. Major challenges arise from optimisation in complex organisations and networks at multiple levels, customer-centric service design, and technology-based innovation management and policy, targeting improvements in business performance, productivity, innovation, resiliency, and economic, social, and environmental sustainability.

Research Challenges

A) Transitioning Socio-technical systems towards sustainability

Research challenge. Managing and supporting decisions in continuously complex environments with multiple stakeholders and overarching goals (e.g., sustainability) brings additional challenges to the research on these methods.

Research Questions

- How can firms innovate their business models through flexibility, self-sufficiency, or servitisation to support sustainability transitions?
- How can innovation management practices evolve through the lenses of Responsible Research & Innovation for sustainability and impact, with a focus on circular value chains, open innovation and co-creation practices?
- How can firms develop new value propositions and service offerings for ecosystem transformation?
- How can firms and policymakers facilitate the effective adoption and diffusion of technologies and develop strategies for citizen cocreation and engagement in sustainability transitions?

B) Developing Responsive and resilient end-to-end Value Chains

Research challenge. The prevailing current global supply chain models impose several challenges (including over-dependencies and logistics issues). Recent crisis (such as the COVID 19 pandemic and the war in Ukraine) have demonstrated the fragilities of those models, both in terms of resilience and sustainability (environmental, social and economic).

Research Questions

- How can digital technologies contribute to reduce the critical dependencies and weaknesses resulting of current global supply chain (SCs) models, including the identification of current and future severe disruptions?
- How can digital technologies contribute to manage the trade-offs and enhance the synergies that characterise the relationship between sustainability and resilience practices in complex value chain environments?
- How can end-to-end SC visibility, supported by emerging technologies, contribute to the development of resilient and sustainable SCs?
- How can digital technologies facilitate joint innovation activities to increase the circularity of products, processes, and overall SCs?
- What is the impact on the organisations' end-to-end performance (with respect to these challenges) to integrate and interface Marketing and Operations?

C) Managing Systems under uncertain, complex and dynamic environments

Research challenge. Managing and supporting decisions in continuously complex environments with multiple stakeholders and overarching goals (e.g., sustainability) brings additional challenges to the research on these methods.

Research Questions

- How to acknowledge, incorporate and intrinsically seize the properties of uncertain and dynamic settings in system modelling, not only as far as data is concerned, but also assumptions and scope?
- How to model complex relationships, including multiple stakeholders with multiple goals and incentives?
- How to improve and significantly fasten the decision-making process to tackle an uncertain and dynamic setting, through innovative solution methods and algorithms?
- What benefits can be derived from multi-disciplinary approaches (namely, the hybridisation with qualitative and strategy-oriented decision-making models with state-of-the-art algorithms, or with enhanced risk assessment and management tools) in complex and dynamic applications such as urban mobility?
- How can AI methodologies be used to optimise critical parameters' trade-offs in designing adaptable production systems?
- How can hybrid simulation models and Digital-Twin-based approaches contribute to more effective operational management in Uncertainty and Complex Manufacturing Environments?
- How to design and manage innovative, more resilient, inclusive and sustainable urban mobility services (for people and freight) in the context of the smart city and the sharing economy?
- How to design and manage innovative global, more sustainable logistics and freight circular transportation services, based on synchro-modal operations and inter-modal hubs?

D) Engineering Human-Centred Systems for Sustainability and Resilience

Research challenge. Demands for sustainability and circularity raise specific challenges to IIS such as trust, and confidentiality from one side, and systems adoption and user engagement on the other side.

The exponential growth of digital technologies applied to manufacturing foster the challenge to create awareness about the socio-technical strategies for technology adoption.

Research Questions

- How to design inter-organisational information systems, particularly industrial digital platforms that support collaboration, information management and collective action to foster and implement circular and sustainable business strategies?
- How to manage industrial data and information in individual organisations and value chains and networks to foster knowledge and unlocking value creation from data?
- How to assess the impact and derive design propositions for information systems based on emerging technologies leading to the creation of organisational capabilities that foster competitiveness and sustainability?
- How to leverage technology and data to create transformative services for value co-creation and system transformation?
- What are the factors that influence the adoption of green and emergent technologies?
- What are the drivers and barriers to the adoption of emergent technologies in the context of Industry 5.0?

Featured Contributions in 2025

Transitioning Socio-technical systems towards sustainability

In the energy and resilience domains, research progressed through several projects. The successful conclusion of Trust-AI reinforced leadership in the development of explainable and trustworthy AI systems. Sustainability-oriented research was reinforced through quantitative analyses of municipal solid waste policy alignment, integrated environmental and nutritional sustainability assessment of dietary patterns, and empirical modelling of energy poverty engagement behaviours across European cities. Climate-adaptive inventory management models for multi-age products (port wine) under price uncertainty delivered interpretable decision rules that significantly improved over benchmark policies. The DECODIT European project contributed to this research line by advancing data-driven governance frameworks for sustainable socio-technical systems, leveraging Living Lab approaches to enable real-world experimentation, stakeholder co-creation, and the validation of citizen-centric solutions fostering transparency, trust, and systemic innovation.

Developing Responsive and resilient end-to-end Value Chains

We continued to study innovative supply chain models and strategies to address complexity and uncertainty. Activities focused on developing and testing circular supply chain design and management strategies, particularly addressing remanufacturing processes and the role of digital technologies as enablers of circularity. The Supply Chain Resilience Fit Model was further applied to textile and agri-food ecosystems within the RISE SME project, including the organisation of workshops with companies. The European project ReSChape concluded, with INESC TEC coordinating the work package on policy recommendations and leading a cross-country European analysis of supply chain-related policies and regulations. The team organised the EurOMA Sustainable Operations and Supply Chains Forum.

Managing Systems under uncertain, complex and dynamic environments

The research advanced multiple lines of inquiry addressing uncertainty and complexity in operational systems. First, significant progress was made in dynamic and stochastic decision making, including adaptive dispatching for job shop scheduling and robust optimisation models for synchronised vehicle routing under travel time uncertainty, complemented by structured reviews in inventory routing and online retail logistics. The PEER European project advanced the application of reinforcement learning methods to address dynamic and complex decision-making problems. PEER's AI-driven personalised routing system plans to enhance the in-store picking efficiency. By optimising the paths for staff during order fulfilment, the system reduces picking time and errors, leading to better inventory management and a smoother shopping experience for customers. Second, work on Digital Twins integrated hybrid optimisation, simulation, and machine learning to support adaptive manufacturing and human centric Industry 5.0 interaction models. Third, mobility research delivered frameworks for demand responsive transport, co designed urban mobility roadmaps, and cooperative last mile logistics. Fourth, studies on intermodal freight enhanced port operations and digital twin adoption. Finally, behaviourally informed optimisation advanced carsharing and taxi performance analytics.

Engineering Human-Centred Systems for Sustainability and Resilience

Research on the design of industrial digital platforms resulted in a validated set of socio-technical design propositions for a digital platform architecture to manage digital twin instances. These results are operationalised through an iterative socio-technical design process spanning strategy, social, ecosystem, organisational, technical, system analysis, and implementation. Research across several projects aimed at developing design knowledge for AI-based systems for industrial applications. A multi-agent architecture applicable to manufacturing was designed and prototyped, including agents that interact with an AAS, significantly improving the quality of model responses and their anchoring to assets and the company's context. A method for reusing ML models in industrial domains that enables more frugal MLOps has been developed and published, leading to a European project proposal currently in preparation. We organised the 26th IFIP/SOCOLNET Working Conference on Virtual Enterprises - Hybrid Human-AI Collaborative Networks, where most of these topics were discussed.

6 THEMATIC LINES

The four thematic lines at INESC TEC - Digital Models, Sustainable Transformation, Tackling the Extreme, and Trustworthy Technology - serve as strategic frameworks for organising and advancing multidisciplinary research activities. These thematic lines facilitate collaboration among researchers from diverse scientific domains, enabling them to tackle impactful and complex research challenges through integrated and innovative initiatives.

6.1 THEMATIC LINE: DIGITAL MODELS

Coordinator: Susana Barbosa

Overview

The Digital Models thematic line focuses on the development of comprehensive, high-precision digital representations of physical systems, leveraging advances in pervasive intelligence and data-driven technologies. It responds to the growing importance of digital twins as a central paradigm in European and global research agendas, enabling the integration of sensing, computation, and decision-making into unified digital ecosystems.

At its core, this thematic line seeks to establish end-to-end digital pipelines that span data acquisition, edge and cloud computing, large-scale data management, modelling, simulation, and advanced visualisation. These pipelines support monitoring, prediction, optimisation, and control, enabling seamless interaction between physical and digital entities. As digital models evolve in complexity and fidelity, they increasingly enable real-time, bidirectional interaction between systems and their digital counterparts, fostering adaptive and intelligent behaviour.

This line mobilises multidisciplinary expertise to address computational, algorithmic, and system-level challenges associated with large-scale modelling. It encompasses advances in artificial intelligence, high-performance computing, communications, sensing technologies, and cyber-physical systems, aiming to push the boundaries of scalability, performance, reliability, and security. The resulting digital models are designed to support critical applications across industry, healthcare, energy systems, and environmental monitoring, contributing to more efficient, resilient, and sustainable systems.

Scientific and Technological Developments

In 2025, research within this thematic line significantly advanced the state of the art in digital modelling, particularly in the development of high-fidelity digital twins and hybrid modelling approaches that combine physics-based and data-driven techniques.

A major focus was placed on the creation of digital representations of complex infrastructures and systems, including energy networks, industrial processes, and mobility systems. These efforts resulted in advanced simulation environments capable of integrating heterogeneous data sources, capturing system dynamics, and enabling scenario-based analysis. Hybrid optimisation and simulation techniques were further refined to support decision-making in complex environments, particularly in contexts characterised by uncertainty and dynamic conditions.

Progress was also achieved in the integration of artificial intelligence into modelling workflows. Machine learning and advanced analytics were embedded into digital models to enhance predictive capabilities, improve adaptability, and enable real-time decision support. These approaches allowed for the development of models that not only replicate system behaviour but also learn from data, enabling continuous improvement and increased accuracy over time.

In parallel, significant advances were made in modelling distributed and interconnected systems, particularly in the context of energy systems and smart infrastructures. Digital twins were developed to represent multi-energy systems, integrating electricity, hydrogen, and other energy vectors, enabling

comprehensive optimisation of production, distribution, and consumption processes. These models support the transition to more flexible and decentralised energy systems, facilitating the integration of renewable energy sources and the optimisation of energy flows.

Another key development area was the modelling of complex operational systems, including supply chains, logistics networks, and manufacturing environments. Advanced optimisation models and simulation techniques were applied to improve efficiency, resilience, and sustainability, supporting real-time planning and adaptive control.

Innovation and Impact

The advances achieved within the Digital Models thematic line translated into a wide range of innovative solutions with strong application potential across multiple sectors.

In industry, digital twins were used to optimise production processes, improve maintenance strategies, and enhance operational safety. These models enabled predictive maintenance, real-time monitoring, and adaptive control, contributing to increased efficiency and reduced operational costs. The integration of digital models with industrial platforms also facilitated the development of scalable and interoperable solutions, supporting the digital transformation of industrial ecosystems.

In the energy sector, digital models played a key role in enabling the transition towards more sustainable and resilient systems. Advanced modelling tools supported the integration of renewable energy sources, the optimisation of energy communities, and the development of new market mechanisms. These solutions contributed to more efficient energy management, improved grid stability, and enhanced flexibility in energy systems.

In healthcare and environmental domains, digital models enabled new approaches to monitoring, diagnosis, and decision-making. High-fidelity simulations supported the analysis of complex biological systems and environmental processes, enabling more accurate predictions and more effective interventions. These developments contribute to improved healthcare outcomes and more effective responses to environmental challenges.

The integration of digital models with emerging technologies such as artificial intelligence, Internet of Things, and advanced communications further expanded their impact. These technologies enabled the creation of interconnected digital ecosystems, where data flows seamlessly across systems, supporting coordinated and intelligent decision-making.

Cross-cutting Contributions

The Digital Models thematic line demonstrated strong interdisciplinarity, bringing together expertise from multiple scientific domains to address complex challenges. This integration enabled the development of holistic solutions that combine modelling, data analytics, and system optimisation.

The work carried out in this line also reinforced international collaboration and alignment with European research priorities, particularly in the areas of digital twins, smart infrastructures, and data-driven systems. By contributing to large-scale initiatives and collaborative projects, this thematic line strengthened its position within the European research landscape.

Overall, the Digital Models thematic line played a central role in advancing the digital transformation of key sectors, providing the tools and methodologies needed to understand, predict, and optimise complex systems in an increasingly data-driven world.

6.2 THEMATIC LINE: SUSTAINABLE TRANSFORMATION

Coordinator: Clara Gouveia

Overview

The Sustainable Transformation thematic line addresses the critical challenge of achieving long-term sustainability across social, economic, and environmental systems. It builds on the integration of multidisciplinary knowledge to develop science-based technological solutions that accelerate the transition towards more sustainable and resilient societies.

This thematic line focuses on the development of innovative approaches grounded in circular economy principles, sustainable supply chain management, sustainable agriculture and food systems and the electrification and decarbonisation of energy, transport and industrial sectors. It explores the intersection between technological innovation and socio-economic systems, aiming to design solutions that are not only efficient but also environmentally responsible and socially inclusive.

By combining advances in energy systems, industrial processes, computer science, robotics and innovation management, this line supports the transformation of existing infrastructures and business models. It emphasises the need for integrated solutions that consider the full lifecycle of products and services, enabling more efficient resource use and reducing environmental impact.

Scientific and Technological Developments

In 2025, research within this thematic line advanced significantly in the areas of energy systems, sustainable industrial and agricultural processes, resilient supply chains, environmental modelling, and sustainable mobility. These developments strengthened the scientific foundation for sustainable transformation across sectors.

A central focus was the development of advanced methods for supporting decarbonisation of energy, transport and industrial sectors. Research addressed modelling and optimising of multi-energy systems, supporting green hydrogen integration and thermal energy storage solutions, carbon-aware EV charging optimisation algorithms and physics-based demand models for electrified maritime ports.

In the **maritime and port sector**, optimisation tools addressing just in time operations, congestion reduction, and electrified port demands provide a foundation for more efficient and sustainable port logistics. Research in sustainable industrial systems also explored the application of digital technologies, including artificial intelligence and digital twins, to support eco-efficient production processes, reduce waste, and improve critical materials utilisation and recovery. Sustainable supply chain management emerged as another key area of research. Innovative methodologies were developed to address uncertainty, enhance resilience, and support circularity in supply networks. These approaches integrated optimisation, simulation, and data analytics to enable more robust and adaptive decision-making.

Multi-objective optimisation models for fishing fleet operations contributed towards more sustainable fishing sector, while advanced optimisation and pricing models support food waste reduction and more efficient inventory management and food systems. Finally, work on wildfire resilience progressed through the development of risk assessment and resilience planning modelling frameworks, while advanced robotics contribute to.

Finally, in the domain of **fisheries and food systems**, new multi-objective optimisation models were developed for cooperative tuna purse seine fleet operations, explicitly representing trade-offs across economic and operational criteria. In retail, the BeFresh project advanced optimisation and pricing models for perishable goods to support food waste reduction and more efficient inventory management.

Thematic work also addressed the socio-technical dimensions of sustainability, including the development of new business models and innovation frameworks. Research explored how organisations can adopt sustainable practices, how technology can support behavioural change, and how innovation processes can be aligned with environmental and societal goals.

Innovation and Impact

The outcomes of this thematic line translated into impactful innovations across energy, industry, and societal systems.

In the energy domain, new tools and platforms were developed to support the operation and optimisation of multi-energy systems, supported by new electricity market models and services. These solutions enabled the development of new energy services, while ensuring secure operation of electricity systems operating with high integration of renewable energy sources. Empowering of energy communities was enable with the implementation of local flexible energy management platforms.

In industrial contexts, innovative solutions contributed to the transition towards more sustainable and resilient production systems and supply chains. Digital technologies were used to optimise manufacturing processes, reduce emissions, and enhance resource efficiency. These developments supported the adoption of circular economy practices, enabling industries to minimise waste and maximise the value of resources.

Significant innovation results were achieved in robotics and IoT solutions that enable more sustainable forestry and agriculture processes, while in transportation sector, significant advances in the development of tools and technologies for the decarbonisation of ports, combining logistics with energy management tools.

The thematic line also contributed to the development of new approaches to innovation and entrepreneurship, supporting the creation of sustainable business models and the exploitation of research outcomes. These efforts fostered stronger connections between research, industry, and society, enhancing the impact of technological innovation.

Furthermore, research outcomes informed policy and regulatory discussions, providing evidence-based insights into the design of sustainable systems and the implementation of effective transition strategies. This contribution supports the alignment of technological innovation with broader societal goals.

Cross-cutting Contributions

Sustainable Transformation is inherently multidisciplinary, integrating expertise from engineering, computer science, management, and social sciences. This integration enabled the development of solutions that address not only technical challenges but also organisational, behavioural, and policy dimensions.

The thematic line also demonstrated strong alignment with international priorities, particularly in the areas of climate change mitigation, energy transition, clean industry, and sustainable development. Through collaboration and participation in international initiatives, it contributed to shaping the global research and innovation agenda in sustainability.

Overall, this thematic line played a key role in advancing the transition towards a more sustainable and resilient society, providing the knowledge and tools needed to address some of the most pressing challenges of our time.

6.3 THEMATIC LINE: TACKLING THE EXTREME

Coordinator: Eduardo Silva

Overview

The Tackling the Extreme thematic line focuses on addressing challenges associated with operating in harsh, complex, and uncertain environments. It brings together multidisciplinary expertise to develop technologies and systems capable of functioning reliably under extreme physical, operational, or environmental conditions.

This thematic line is driven by the need to respond to critical societal challenges, including climate change, natural disasters, and the exploration and monitoring of difficult-to-access environments such as oceans environments, remote regions, extreme temperatures, etc. It leverages advances in robotics, sensing, communications, and artificial intelligence to enable robust and autonomous operation in these contexts.

By integrating physical systems with advanced computational capabilities, this line aims to enhance the ability to observe, analyse, and act in extreme environments, supporting applications ranging from environmental monitoring and disaster response to industrial inspection and security.

Scientific and Technological Developments

In 2025, research in this thematic line advanced significantly in the development of autonomous systems, advanced sensing technologies, and robust computational methods for extreme environments.

A key area of progress was the development of robotic systems capable of operating in challenging conditions, including deep-sea, offshore, and remote environments. These systems integrated advanced perception, navigation, and control capabilities, enabling autonomous operation in complex and dynamic scenarios. Research focused on multi-sensor fusion, real-time mapping, and robust localisation, supporting reliable operation even in environments with limited visibility or communication constraints.

Advances were also achieved in sensing and monitoring technologies. Novel approaches were developed for distributed sensing, enabling the monitoring of large-scale infrastructures and natural environments. These technologies combined optical, acoustic, and electromagnetic sensing methods to provide high-resolution data in real time.

In parallel, significant progress was made in the development of data processing and analysis methods tailored to extreme conditions. These included approaches for handling sparse, noisy, or uncertain data, as well as algorithms designed to operate under limited computational resources. Edge computing and distributed processing architectures were explored to enable real-time decision-making in environments where connectivity is constrained.

Thematic work also addressed the modelling and simulation of extreme scenarios, including natural hazards and critical system failures. These models support risk assessment, planning, and response strategies, enabling more effective management of extreme events.

Innovation and Impact

The research outcomes of this thematic line led to impactful innovations in sectors where reliability and performance under extreme conditions are critical.

In maritime and environmental domains, advanced robotic systems and sensing technologies enabled new capabilities for monitoring and exploration. These solutions supported applications such as environmental protection, infrastructure inspection, and resource management, contributing to improved understanding and stewardship of natural environments.

In security and defence contexts, technologies developed within this line enhanced situational awareness and operational capabilities in complex scenarios. Autonomous systems and advanced sensing solutions provided reliable support for surveillance, inspection, and intervention tasks.

Industrial applications also benefited from these developments, particularly in sectors such as energy, where operations often take place in harsh environments. Technologies for inspection, monitoring, and maintenance contributed to increased safety, reduced operational risks, and improved efficiency.

The thematic line also contributed to disaster response and resilience, providing tools and systems that support early detection, monitoring, and response to extreme events. These capabilities are essential for mitigating the impact of natural hazards and enhancing the resilience of communities and infrastructures.

Cross-cutting Contributions

Tackling the Extreme required strong integration across disciplines, combining expertise in robotics, sensing, communications, and data analytics. This integration enabled the development of systems that are not only technically advanced but also robust and adaptable to a wide range of challenging conditions.

The thematic line also fostered collaboration with international partners and stakeholders, contributing to large-scale initiatives focused on environmental monitoring, ocean exploration, and disaster resilience. These collaborations enhanced the visibility and impact of the research carried out.

Overall, this thematic line strengthened the ability to operate in and understand extreme environments, providing critical technologies and knowledge to address some of the most demanding challenges faced by society.

6.4 THEMATIC LINE: TRUSTWORTHY TECHNOLOGIES

Coordinator: Rui Oliveira

Overview

The Trustworthy Technologies thematic line focuses on the development of reliable, secure, and ethically aligned digital systems that can be confidently deployed in critical societal contexts. It addresses the growing need to ensure that technological advances are not only powerful but also transparent, fair, and aligned with human values.

This thematic line integrates expertise from multiple scientific domains to tackle challenges related to security, privacy, robustness, and ethical design. It emphasises the importance of building systems that users can trust, particularly as digital technologies become increasingly embedded in everyday life and critical infrastructures.

Key priorities include the development of explainable artificial intelligence, secure and privacy-preserving systems, and resilient digital infrastructures. The line also addresses the societal implications of technology, ensuring that innovation contributes positively to society while minimising risks.

Scientific and Technological Developments

In 2025, research in this thematic line advanced significantly in areas related to cybersecurity, privacy-preserving technologies, and explainable artificial intelligence.

A major focus was placed on developing methods to enhance the transparency and interpretability of AI systems. Research explored new approaches to explainable machine learning, enabling users to understand and trust the decisions made by complex models. These approaches are particularly relevant in sensitive domains such as healthcare, where reliability and accountability are critical.

Significant progress was also made in cybersecurity and privacy. New techniques were developed to protect data and systems against emerging threats, including advanced attack models and distributed environments. Research addressed secure communication, encrypted data processing, and resilient system architectures, ensuring that digital systems remain robust under adversarial conditions.

In addition, advances were achieved in the development of dependable software and systems. Formal methods, testing frameworks, and verification techniques were applied to ensure system correctness and reliability, particularly in safety-critical applications.

The thematic line also explored the integration of ethical considerations into system design. Research addressed issues such as fairness, bias, and accountability, developing frameworks and tools to support responsible innovation. These efforts contribute to the development of technologies that are aligned with societal values and regulatory requirements.

Innovation and Impact

The outcomes of this thematic line had significant impact across multiple domains where trust and reliability are essential.

In digital services and platforms, technologies developed within this line enhanced security, privacy, and user trust. These solutions enabled the deployment of advanced digital services while ensuring the protection of sensitive data and the integrity of systems.

In critical infrastructures, including energy and communications, research contributed to the development of secure and resilient systems capable of withstanding disruptions and cyber threats. These capabilities are essential for maintaining the stability and reliability of essential services.

In healthcare and other sensitive domains, advances in explainable and trustworthy AI supported the adoption of data-driven approaches while ensuring transparency and accountability. These developments

facilitate the integration of AI into decision-making processes, enhancing outcomes while maintaining trust.

The thematic line also contributed to shaping best practices and standards for trustworthy technology, supporting organisations in adopting secure and ethical approaches to innovation.

Cross-cutting Contributions

Trustworthy Technologies is inherently cross-cutting, requiring the integration of technical, ethical, and societal perspectives. The thematic line fostered collaboration across disciplines to address complex challenges that cannot be solved from a purely technical standpoint.

It also demonstrated strong alignment with international priorities related to digital sovereignty, cybersecurity, and ethical AI. Through collaboration and engagement with stakeholders, this line contributed to the development of frameworks and approaches that support responsible digital transformation.

Overall, this thematic line played a crucial role in ensuring that technological innovation is accompanied by trust, reliability, and ethical responsibility, enabling the sustainable and inclusive adoption of digital technologies.

7 TEC4 INITIATIVES

7.1 Overview

TEC4 (TEChnologies FOR...) is an organisational approach designed to structure the market-driven innovation process, complementing the naturally occurring science-driven research conducted within Research Centres. This approach fosters a balanced and integrated knowledge-to-value chain.

Short-term objectives of TEC4 initiatives include:

- Developing innovative, knowledge-based solutions and services with high export potential;
- Leveraging internationally competitive research and innovation capabilities;
- Contributing to the resilience and growth of the Portuguese economy.

Long-term objectives encompass:

- Identifying scientific and technical challenges across diverse fields;
- Harnessing the full potential of INESC TEC in application domains relevant to businesses.
- Establishing and sustaining virtuous innovation cycles within each TEC4.

Each TEC4 focuses on a specific market segment and fosters **cross-cluster, multidisciplinary projects**. They actively collaborate with businesses to develop solutions for technology transfer. Each TEC4 also maintains a **strategic agenda** aligned with its market domain, addressing:

- Stakeholder perspectives;
- Strategic roadmap and associated technological roadmap;
- R&D infrastructure evolution to maintain state-of-the-art capabilities and support the roadmap.

TEC4 application areas are aligned with European, national, and regional priorities, fostering internal R&D competencies around socio-economic pillars. Additionally, attracting **international partners** supports INESC TEC's internationalisation strategy, facilitates access to international partners for national companies, and fosters foreign direct investment.

Performance measurement for each TEC4 primarily considers:

- **Level of recognition and activity** within its market (including direct contracts with companies and stakeholders);
- Number of inter-Centre collaborations generated.

TEC4s are not directly involved in project development. Once an opportunity is identified, negotiations occur with relevant Centres, which then manage and execute the project.

Typically, a TEC4 comprises:

- **A defined market domain** represented by businesses and associations;
- **A group of INESC TEC Centres** with multidisciplinary expertise relevant to the market domain;
- **R&D infrastructure** supporting scientific and innovation activities and providing added-value services to businesses.

Each TEC4 follows a structured implementation plan encompassing the following stages:

- **Identification of market segments** where INESC TEC competencies can create value;
- **Assessment of market needs** to identify internal research lines with the highest potential impact on businesses;
- **Evaluation of R&D infrastructure** (laboratories, equipment, demonstration facilities, etc.) to support value-added services for businesses;

- **Identification of potential partners and stakeholders** who can contribute to the TEC4 and its innovation cycle;
- **Definition and alignment of the strategic agenda** for each TEC4 and creation of its advisory board.

The current TEC4 organisation comprises:

- **Five established TEC4s:**
    - TEC4AGRO-FOOD: Focuses on the agro-food and forestry sectors;
    - TEC4ENERGY: Addresses energy-related activities and the energy economy;
    - TEC4HEALTH: Targets activities and the economy related to health and well-being;
    - TEC4INDUSTRY: Concentrates on production technologies, manufacturing, distribution, logistics, and retail;
    - TEC4SEA: Focuses on sea-related activities and the maritime economy.
- **TECPARTNERSHIPS:** Primarily dedicated to promoting and supporting businesses in all other sectors, exploring new market segments, and incubating potential new TEC4s until they reach a sufficient maturity level.

TEC4s are dynamic organisational models that require periodic evaluation and adaptation to the evolving economic landscape.

7.2 TEC4AGRO-FOOD

Coordinator: Filipe Neves dos Santos

Business Developer: André Sá

Presentation

TEC4AGRO-FOOD is INESC TEC's Initiative for Agro-Food and Forestry.

TEC4AGRO-FOOD's mission is co-creating the digital (r)evolution in agro-food and forestry through research and technological development in digital technologies and robotics for the creation of long-term value for INESC TEC from customers, markets, and relationships.

TEC4AGRO-FOOD has as main application areas Smart (digitalisation) Precision ("right time, right treatment, right amount, right place") Agriculture and Forestry, Food Security and Bioeconomy. TEC4AGRO-FOOD may act in all phases of the smart precision agriculture/forestry cycle, from variability measurement to action with variable rate technologies (VRT), encompassing data analysis and decision and prescription map:

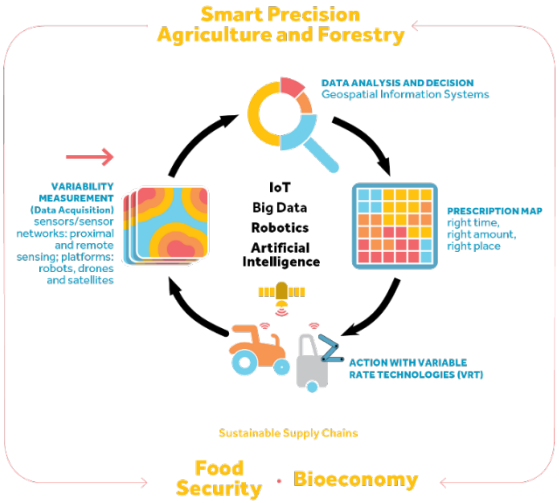


Figure 7.1 - Precision Agriculture/Forestry Action Cycle

TEC4AGRO-FOOD provides innovation services of advanced consultancy and research and technological development in the mentioned application areas.

TEC4AGRO-FOOD has proven to be a very cross-cutting initiative regarding INESC TEC's R&D centres, with most of them being involved in it, being CRIIS, namely through TRIBE Lab - Laboratory of Robotics and IoT for Smart Precision Agriculture and Forestry, the most active one

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Main achievements in 2025

Continuing to follow the overall strategy of full implementation of portfolio projects, namely, in the last years, at the level of the Recovery and Resilience Plan, and redoubling efforts with companies and at the international level, as well as the strategy defined in the TEC4AGRO-FOOD's Strategic Plan, in 2025 TEC4AGRO-FOOD pursued its consolidation as the main national research and technological development partner in the scope of digital technologies and robotics for agro-food and forestry. At the same time, at European level, TEC4AGRO-FOOD has reached a sustainable position regarding research and innovation programmes, namely Horizon Europe. Should also be highlighted the increased visibility (press, events, etc.) and the contribution to the public policies (RIS3 and CoLABs - INESC TEC participates in 3 CoLABs in the scope of TEC4AGRO-FOOD).

TEC4AGRO-FOOD's main achievements in 2025 are presented below:

- National R&D Programmes: (FCT) CIDERWISE (21.2k€) (CESE), CCAgroHealth (100.0k€) (C-BER), WaveSense (162.0k€) (CAP) and IGNIT (71.3k€) (CEGI and CESE); (PT2030) SFERT2M (164.0k€) (CRIIS), SMARTCUTv2 (123.6k€) (CRIIS), DFence (271.2k€) (CESE) and WATERKNOW (125.1k€) (HumanISE).
- European Programmes approvals: (HEU) AGROBOOST (485k€) (CTM and CRIIS) and GREENGROCER (286.9k€) (LIAAD).
- R&D Services and Consulting contract awards: LOCPLANT (CRIIS), 5GCover (CTM), Agro_MTA (C-BER), VineShieldDT (CRIIS and HumanISE (4.6k€) (CAP), SMARTLabel (CTM) and Modular_X_INIAV (CRIIS).
- Prizes: Modular-E - 2nd place in "Best World FIRA 2025 Robot" (second consecutive year) (CRIIS), Modular-E - finalist in the Innovation Vanguard Awards (CRIIS), Pocket Vet - honourable mention in the Amélia de Mello Foundation Research Grants - Jorge de Mello Industry and Innovation Grant (CRIIS), Wine4Cast - +Sustainable Douro Distinction VITICULTURE - IVDP 2025 (CRIIS) and Smart Farm 4.0 - honourable mention in the European Funds Awards (CRIIS and CAP).
- Intellectual Property Rights:
    - Results mapped: By-product digital map (SYSTEM) (PDF25-0018), KPI Interface (SYSTEM) (PDF25-0019), Tribe-rp-drivers (CRIIS) (PDF25-0025), MapCrops (C-BER) (TDF25-0010), Orioos (CRIIS) (TDF25-0043), RL-Sense (CRIIS) (TDF25-0054) and BudScan (CRIIS) (TDF25-0056);
    - Intellectual Property Rights: SpecTOM (CRIIS) (EP concession), BBSpectral (CRIIS) (EP concession), Orioos (I-DEPOT, soft registration), Tribe-rp-drivers (INESC TEC's Open-Source Software (OSS) initiative).
- Advanced Training: André Sá's completion of the "Optimising vineyard operations using innovative techniques/technologies" Training Course (Vine & Wine PT) and completion of the "Sustainable Energy Transition in Agriculture' webinar series (Tools4AgriEnergy).
- Main events: INESCTEC.OCEAN Kick-Off Meeting, Vinhos Verdes Insights, World FIRA 2025, INESC Brussels HUB Winter Meeting 2025, Dare2Change Conference, INESC TEC´s Entrepreneurship and Spinoffs Office launch event, AgroIN 2025 (R&D Partner), Open Session with EARTO at INESC TEC, Industry General Meeting Innovation and Digitisation (IACA e FeedInov CoLab), ARTEX 25 (dual-use robots), Synergy Day by INESC TEC 2025 (2nd edition), visit by the Rectorate of Uni-CV

to INESC TEC, Open Day - TRIBE Lab (INESC TEC), AGROGLOBAL 2025, INESC TEC 2025 Strategic Meeting “Future thinking”, FP10 and the European Competitiveness Fund (INESC Brussels HUB), INIAV Conference “Challenges of Research in the Agrifood and Forestry Sector”, visit by UFSM delegation to Portugal, 10th edition of INESC TEC's Autumn Forum, EuroTech Day and Vinhos Verdes Insights: Review of the 2025 Wine Year.

7.3 TEC4COMMUNICATIONS

Coordinator: Manuel Ricardo

Presentation

The digitalisation of economic sectors requires advanced communications networks, services, and applications. Emerging sectors such as manufacturing, energy, mobility, logistics, and digital health increasingly depend on reliable and flexible communications infrastructures. Future communication systems will be highly configurable, increasingly virtualised, and capable of supporting sensing functionalities in addition to connectivity.

The development of such systems requires multidisciplinary expertise. INESC TEC brings together competences in microelectronics, photonics, energy systems, robotics, artificial intelligence, computing, and digital business models. This combination enables the development of integrated technological solutions addressing both technical and economic challenges associated with next-generation communications infrastructures.

TEC4COMMUNICATIONS aims to create an innovation ecosystem that connects research organisations, companies, and public stakeholders. The initiative focuses on three main groups of partners: producers of communications technologies and systems, large industrial users requiring advanced communications and sensing infrastructures, and policymakers responsible for regulatory and strategic frameworks.

Through this collaborative approach, TEC4COMMUNICATIONS promotes experimentation with emerging technologies and accelerates the transfer of research results into applications. The initiative also supports the development of new services, infrastructures, and business models based on advanced connectivity and sensing capabilities.

The innovation activities associated with TEC4COMMUNICATIONS will be supported by the new Communications and Machine Perception Laboratory, to be established in Matosinhos. This infrastructure will provide experimental facilities for research, development, and testing of advanced communications and sensing technologies. The laboratory will include specialised experimental zones and spaces for collaboration with startups and industrial partners, strengthening the regional innovation ecosystem.

Main achievements in 2025

During 2025, TEC4COMMUNICATIONS achieved several important milestones.

Strengthening partnerships.

Engagement with key stakeholders was reinforced at both national and international levels. At the national level, relationships were consolidated with major telecommunications operators, Portuguese telecommunications associations, the national telecom regulator, and large industrial companies interested in private communications infrastructures. At the international level, contacts were strengthened with organisations operating telecommunications research infrastructures similar to the one planned at INESC TEC.

Funding for the new laboratory.

A funding application for the construction of the building that will host the Communications and Machine Perception Laboratory was successfully approved. The new facility will include several experimental zones, such as a reconfigurable anechoic chamber, a sensing laboratory, an autonomous systems arena, an electronics laboratory, and a computational cluster supporting large-scale data processing and artificial intelligence workloads.

Recruitment of a business developer.

The TEC4COMMUNICATIONS business developer was selected. This role will support the preparation of the initiative's business plan during 2026 and contribute to defining TEC4COMMUNICATIONS' positioning, value proposition, and engagement with the innovation market.

7.4 TEC4ENERGY

Coordinator: João Peças Lopes

Business Developer: Alberto Jorge Bernardo

Presentation

The primary objective of TEC4ENERGY is to identify technological needs when decarbonising the economy leading to research, development, and innovation activities for the energy sector, that can be delivered by INESC TEC. By bringing together a wide range of stakeholders, including R&D institutions, companies, and associations, TEC4ENERGY seeks to enhance collaboration among stakeholders and reinforce both internal and external synergies, enabling the effective response to the major challenges that society - and particularly the energy industry - will face in the future. The initiative is also designed to stimulate the growth of energy-related industries and to facilitate the transformations required for a more digitalised, sustainable, and low-carbon future.

TEC4ENERGY works closely with industry through advanced consultancy and training services, contract-based R&D activities with a strong emphasis on technology transfer, and the establishment of strategic partnerships. Through these actions, it aims to foster innovation and help the energy sector overcome its current limitations and challenges at both national and international levels. TEC4ENERGY acts as a bridge between industry and all INESC TEC Centres, leveraging their expertise, resources, and experience to deliver successful projects and high-impact services within the energy domain.

The mission of TEC4ENERGY is to promote and capitalise on INESC TEC's well-recognised expertise in Electric Power Systems when developing new collaborative industrial initiatives and EU-funded projects. TEC4ENERGY's role is to attract and support business opportunities and funded projects that contribute to the achievement of INESC TEC's mission and strategic objectives, which are aligned with the EU's priorities of addressing societal challenges, fostering innovation, and advancing towards a more digitalised, sustainable, and decarbonised energy sector.

Overall, TEC4ENERGY plays a pivotal role in advancing innovation in the energy sector by identifying and leveraging projects that address the limitations of existing technologies provided by industry. Through its multidisciplinary and collaborative approach, TEC4ENERGY contributes to the advancement of knowledge and technological progress in the energy field, generating benefits for both industry stakeholders and society at large.

Main achievements in 2025

TEC4ENERGY catalysed strategic engagement with national and international stakeholders across key energy domains involving hydropower and renewable generation technologies, energy storage systems, power markets and tariffs, planning and operation of electric grids and security of supply, use of hydrogen for sector coupling, control of electrolysers, electric mobility, traction power and industrial plants, directly advancing the digital and decarbonised transition in alignment with European Commission priorities.

By mobilising INESC TEC's multidisciplinary Technology Centres, TEC4ENERGY accelerated cross-sector collaboration and delivers high-impact, innovation-driven solutions to the energy industry.

Aiming at promoting a closer contact with international and national stakeholders, TEC4ENERGY organised the participation of INESC TEC at ENLIT, which was held in Bilbao, Spain, between 18th and 20th of November 2025. ENLIT is Europe's largest energy event with global reach, gathering stakeholders across generation, renewables, electric grids, and green hydrogen. It provides a key platform for organisations such as INESC TEC to showcase innovative solutions supporting the digital and sustainable energy transition. INESC TEC exhibited at a 12 sqm booth, showcasing innovative energy solutions and projects. The stand attracted strong interest, with visits from over 80 organisations. A demonstrator integrating PlugTecAC (AC EV wall box), DERway (DER Gateway), and FlexiHome (Residential Energy Management System) was presented. Three opportunities and 15 business leads were identified.

TEC4ENERGY also organised the Energy Technology Open Day, held on 15 October 2025 at the main auditorium of the Faculty of Engineering of the University of Porto, Portugal, bringing together INESC TEC

talent and energy industry visitors. The event welcomed 200 participants from industry, network operators, academia, and INESC TEC. It featured the pitch session “Watt’s Next?”, where seven innovative projects by INESC TEC researchers were presented, with the best pitch receiving an award. A round table, moderated by Professor João Peças Lopes, addressed electric mobility, renewable energy communities, and AI in the energy sector, with speakers from Cleanwatts Digital, ATE (Alliance for the Energy Transition), Siemens eMobility, and Coopérnico. A cocktail followed, during which participants could explore demos of the seven pitched technologies.

In 2025, TEC4ENERGY significantly contributed to INESC TEC’s business portfolio, helping secure over €2 million in advanced consulting services and R&D project funding. Key projects resulting from TEC4ENERGY activities include:

Contracts with Industry

- DGEG – Direção Geral de Energia e Geologia / Directorate-General for Energy and Geology
  - Technical Studies on National Electricity System Security, Flexibility, for the Energy Storage Strategy
- REN – Redes Energéticas Nacionais / Portuguese TSO
  - Advanced training
  - Voltage control architecture and solutions for the Portuguese transmission grid
- EDP Produção / Electricity generation company of EDP Group
  - Technical support for the provision of Frequency Containment Reserve services of a hydropower plant
  - Development of a computational model for the Valorisation of the Use of Water in the Iberian electricity market
- IP – Infraestruturas de Portugal / Infrastructures of Portugal
  - Assessment of Commercial Terms for Connecting Future Railway Substations on the Porto–Lisbon and Porto–Valença High-Speed Railway Lines
- BONDALTI
  - Power Factor Compensation Study for the Estarreja Industrial Plant
- APIERAM
  - Building a remuneration tariffs proposal for renewable power plants in Madeira.
- ELECPOR
  - Market splitting and optimisation of the net transfer capacity between Portugal and Spain.

R&D Project funding

- PowerUp, led by i-charging
  - High-Power Fast Charging for Heavy Electric Vehicles
- H2SYMBIOTIC, led by Winpower
  - Multi-Sector Hydrogen Integration for Decarbonisation and Circularity

7.5 TEC4HEALTH

Coordinator: To be Appointed

Presentation

TEC4Health is the INESC TEC platform focused on research, innovation and technology transfer in the health domain, acting as a bridge between scientific and technological capabilities, healthcare institutions, industry and public stakeholders. Its activity addresses challenges across prevention, diagnosis, treatment, monitoring and health system organisation, with a strong emphasis on digital technologies, data-driven approaches and advanced sensing solutions.

The platform operates following a market- and needs-driven approach to R&D, supporting the development of technologies from early research stages to validation in real healthcare contexts, in close collaboration with hospitals, healthcare providers, companies and public entities. TEC4Health brings together competencies from multiple INESC TEC research centres, covering areas such as artificial intelligence, data analytics, medical imaging, software and information systems, sensors and micro-technologies.

Main achievements in 2025

In 2025, the activity of TEC4Health combined the consolidation of a major national mobilising agenda with the execution of several relevant European and national R&D projects. While INESC TEC's participation in the Health from Portugal (HfPT) Mobilising Agenda of the Recovery and Resilience Plan (PRR) constituted the main structured achievement of the year, other projects contributed decisively to strengthening TEC4Health's research, innovation and clinical application portfolio.

- Health from Portugal (HfPT) – Contribution to the national PRR mobilising agenda through the development of concrete technological results across different contexts of the health system, including:
    - digital and non-invasive intraoperative localisation and planning systems for breast cancer surgery using augmented reality and artificial intelligence
    - computer-assisted detection solutions for computed tomography angiography examinations, integrated into the Champalimaud Foundation's PACS system
    - continuous learning methods for segmenting, detecting and classifying lung cancer, including cancer subtypes and mutations
    - software for analysing data collected by wearable sensors
    - platforms supporting the management and sharing of medical data between heterogeneous systems
    - an innovative microfluidic method for embedding optical fibres in microfluidic devices, resulting in a patented technological solution
- AI4LUNGS (Horizon Europe – Cluster Health) – Development of AI-based personalised care solutions for respiratory diseases, focusing on patient stratification using multi-modal clinical data.
- PHASE IV AI (Horizon Europe – Cluster Health) – Contribution to privacy-compliant health data services for artificial intelligence development, addressing data protection, governance and secure reuse of clinical data.
- GATE / EndoRadiomics / CardioComplete – Development of artificial intelligence solutions for medical imaging and clinical decision support, including computer-assisted endoscopy, radiomics approaches and automatic cardiovascular reporting.
- PULSE / WeFetal – Development of wearable and sensing-based technologies for physiological signal acquisition and analysis, supporting monitoring and data-driven decision-making in healthcare contexts.

7.6 TEC4INDUSTRY

Coordinator: Américo Azevedo

Business Developer: Pedro Senna e Vasco Teles

Presentation

TEC4INDUSTRY is a strategic initiative designed to reinforce the competitiveness of Portuguese industry by fostering science-based, cross-sectoral innovation and by promoting value-creating linkages between INESC TEC and the industrial sector. In line with the 2025 strategic framework, the initiative has continued to consolidate its role as a structuring interface between research and technological capabilities, technology transfer, industrial service provision and collaborative funding opportunities, with a particular focus on digital transformation, advanced manufacturing, stakeholder engagement and the scaling of solutions with clear industrial applicability and impact.

Main achievements in 2025

In 2025, TEC4INDUSTRY further consolidated its role as a driving force for industrial innovation through the combined advancement of stakeholder engagement, infrastructure promotion, project coordination and business development activities. Throughout the year, the initiative supported the continued expansion of the Industry and Innovation Lab (iiLab), reinforced its leadership in activities associated with the Recovery and Resilience Plan (PRR), broadened its portfolio of Horizon Europe, service-related and national funding proposals, and strengthened the Industry Club as a platform for structured engagement with industrial decision-makers. Collectively, these developments contributed to reinforcing INESC TEC's strategic positioning in advanced production technologies and in the digital transformation of the Portuguese industrial ecosystem.

Industry and Innovation Lab (iiLab)

During 2025, the iiLab infrastructure further expanded its relevance as a demonstrator and experimentation environment for advanced industrial technologies. The team supporting the initiative grew, and TEC4INDUSTRY continued to foster the articulation between scientific capabilities, industrial needs and demonstrator-based validation. A key milestone was the continued application of six additional industrial pilots under the Industry Vertical of the TestBed 5G NOS, covering sectors similar to those addressed in 2024 and maintaining the same technological maturation logic, with entry TRLs of 4 and target exit TRLs of 6. Beyond pilot development, TEC4INDUSTRY promoted the iiLab Open Day within the scope of both PRR PRODUTECH R3 and the TestBed 5G NOS initiatives. This action contributed to consolidating the partnership with NOS Telecommunications, while increasing the visibility of INESC TEC solutions and of partner companies such as AZITEK, Azevedos, Flowbotic, JPM and Infinite Foundry. Through this combination of pilot execution, stakeholder mobilisation and public demonstration, iiLab strengthened its role as a gateway for validation, dissemination and future industrial uptake.

Plan Recovery and Resilience (PRR)

Ensuring alignment between technological development and industrial application.

Across the year, the team supported the development, testing and public presentation of several technologies spanning teleoperation of robots, simulation and optimisation for layout design, robotic unpacking solutions, digital twin development and implementation, and other advanced manufacturing technologies. This work reinforced TEC4INDUSTRY's capacity to connect research teams, industrial partners and demonstration opportunities under a coherent innovation management approach. The initiative also gained visibility through several high-level engagements. TEC4INDUSTRY was invited to present solutions at the Navigator Digital Forum, where INESC TEC was the only entity from outside the SEMAPA-controlled group to showcase technical solutions, and participated in presentations with SIEMENS. In parallel, the iiLab Open Day was used to demonstrate both PRODUTECH R3 developments and industrial pilots from the TestBed 5G NOS. TEC4INDUSTRY further encouraged coordinated partners to demonstrate their own solutions publicly, including the joint demonstration hosted by Têxteis Penedo with LTP Labs and SMARTEX, supported by INESC TEC's simulation and AI teams, for IAPMEI and other stakeholders. At ecosystem level, TEC4INDUSTRY also motivated partner visibility during the annual

PRODUTECH R3 Summit, where coordinated partners represented around half of the demonstrators on display, with more than ten solutions showcased. The initiative additionally participated in LogiPack 2025 in Nuremberg, presenting INESC TEC's approaches in simulation, optimisation, AI development, and industrial and mobile robotics, and securing multiple contacts for future initiatives. Through structured project management and active stakeholder orchestration, TEC4INDUSTRY continues to bridge research and industry, ensuring advanced technologies transition into real-world applications and reinforcing its role in Portugal's industrial digital transformation.

Horizon Europe, Services, and Collaboration Proposals

In 2025, TEC4INDUSTRY reinforced its role in fostering research collaborations, securing funding opportunities, and developing tailored services that respond to concrete industrial needs. By leveraging multidisciplinary expertise across INESC TEC's research centres, the initiative contributed to a broad portfolio of European, national and market-driven opportunities, spanning Horizon Europe, direct services, international collaborations, PRR follow-up instruments and other national funding schemes.

Under Horizon Europe, TEC4INDUSTRY supported a portfolio of more than thirty proposal initiatives across Cluster 3, Cluster 4, Cluster 5, the EIC Transition, Marie Sklodowska-Curie Actions and cascade funding instruments. The pipeline addressed themes such as human-centric and trustworthy AI for manufacturing, smart factories, remanufacturing, advanced sensors, cybersecurity and industrial energy systems. Among the most significant proposals by INESC TEC participation value were GRAVITON (EUR 1.39M), SMART-HAND (EUR 1.01M), NeuralFactory (EUR 0.76M), compAIgnion (EUR 0.59M), DigiWin (EUR 0.56M) and SHIFT50, alongside additional initiatives such as CHISAM, OPERHA and HAIQU.

In services, TEC4INDUSTRY developed a strong national pipeline complemented by selected international opportunities. The national portfolio included more than forty service proposals covering consultancy, technology transfer, training and demonstrator support for companies such as W2V, Amorim, Petrotec, Covipor, Prozis, NOS, Corticeira Amorim and others. Higher-value opportunities included PLATO, Protect, RFIDCORK, RAPID and SIMLAYOUT, reflecting sustained demand for capabilities in process optimisation, traceability, simulation, digital twins, logistics, AI and industrial decision support. At international level, the initiative also advanced targeted opportunities such as BIOFAB and other collaboration-driven services linked to industrial innovation and business development.

Regarding the follow-up to the PRR programme and other national funding lines, TEC4INDUSTRY also supported a diversified portfolio of mobilising agendas, SIACs, PREI/co-promotion initiatives, and FCT-funded projects. The flagship case remained PRODUTECH R3, with an INESC TEC participation value of approximately EUR 3.33M, complemented by PRR-related initiatives such as CLEVER. Within Portugal 2030 and associated instruments, relevant examples included Retail AI for Scalability and Excellence, STEP2DIGITAL and decarb4SMEs, while the wider pipeline also covered additional co-promotion and PITD initiatives oriented towards industrial digitalisation, sustainability, robotics, materials and sector-specific transformation. Parallel to this, TEC4INDUSTRY engaged in FCT opportunities and other national calls addressing topics such as cybersecurity, logistics, maritime systems, enterprise AI and resilient digital infrastructures.

Industry Club Initiative

In 2025, TEC4INDUSTRY continued the consolidation of the Industry Club, building on the work initiated in 2024 and significantly expanding its reach. The community grew to close to 500 members and hosted a diverse set of initiatives, including Masterclasses, Speed Summits and Open Days designed to promote networking, visibility and the exchange of practical experiences around industrial transformation. These activities reinforced the Industry Club as a structured platform for engaging industrial leaders, technology providers and innovation stakeholders.

The year culminated in the "Voices of Industry" Conference, now established as the initiative's annual flagship event. Organised with strong public visibility, the conference gathered leaders and companies to debate the digital transformation of industry and to highlight exemplary cases of innovation, further reinforcing the joint positioning of the Industry Club partners. By leveraging this growing network and its regular programme of activities, INESC TEC strengthens its stakeholder management strategy, creates new business opportunities and deepens its connection with decision-makers across the Portuguese industrial ecosystem.

7.7 TEC4SEA

Coordinator: Eduardo Silva

Presentation

The TEC4SEA initiative addresses the Blue Economy sectors, stimulating related industries and partners to overcome the future challenges in these sectors incorporating INESC TEC contributions and know-how. To this end, TEC4SEA brings together entities of the quadruple-helix (academia & research, business, civil society, and policymakers) in order to increase synergies and critical mass, raising up a north based Ocean Engineering Excellence Network capable of leading international initiatives in the Sea Economy.

The multidisciplinary application-oriented solutions addressed by TEC4SEA cover a wide range of industries confronted with numerous challenges and global transitions. From specific regional and national challenges to the Horizon Europe and Mission's objectives, the new European vision targeting 2050, all Blue Economy sectors are confronted with innovation demands. Aiming at bringing the autonomous and digital worlds to a sustainable sea economy, TEC4SEA promotes the following innovation services for the Blue Sectors:

- Development of optical and biosensors (for physical, chemical and bio parameters);
- Broadband communications solutions;
- Heterogeneous data integration and management;
- Development of customised visualisation tools, virtual and augmented reality solutions;
- Offshore RES & DER integration;
- Multiple energy vectors integration;
- Digital Twin and logistic optimisation solutions;
- Conception, development and optimisation of sea mission oriented robotic platforms;
- Conception and development of permanent underwater system platforms;
- Conception, development, test and optimisation of offshore infrastructures:
- Customised processing solutions and on-board processing optimisation;
- Perception solutions for unstructured environments, 3D mapping and data fusion;
- Optimisation of underwater positioning systems and navigation algorithms.

The centres involved in TEC4SEA projects during 2025 were the following: CAP - Applied Photonics; CPES - Power and Energy Systems; CRAS - Robotics and Autonomous Systems; HumanISE - Human-Centred Computing and Information Science; and CTM - Telecommunications and Multimedia.

Main achievements in 2025

INTERNAL

1. Continued the consolidation of TEC4SEA as the integrative platform for ocean-related research at INESC TEC, strengthening coordination with associated research centres and aligning institutional priorities in the Blue Economy domain.
2. Reinforced internal coordination mechanisms to enhance collaboration across research teams, facilitating multidisciplinary initiatives in ocean technologies, maritime systems, and energy transition.
3. Supported the operationalisation and strategic positioning of INESCTEC.OCEAN, contributing to the articulation between institutional stakeholders, national authorities, and international partners.

4. Advanced the development and utilisation of shared research infrastructures for ocean technologies and maritime innovation, including activities associated with Hub Azul de Leixões and related test and experimentation facilities.
5. Continued the internal alignment with the TEC4SEA medium-term strategic, fostering opportunities in European programmes (e.g., Horizon Europe), national funding schemes (PT2030, Mar2030), and collaborative initiatives with industry.

EXTERNAL

1. Promoted TEC4SEA infrastructure and research capabilities to national and international stakeholders, fostering opportunities for R&D collaboration, technology transfer, and industrial engagement.
2. Continued the positioning of INESC TEC in the ocean renewable energy ecosystem, reinforcing participation in activities associated with the Aguçadoura offshore test site and related innovation initiatives.
3. Strengthened collaboration with international organisations and research institutions in the ocean domain, consolidating partnerships and strategic dialogue with entities such as Sintef, EMSA, ISA, and UN-related initiatives.
4. Supported the implementation and consolidation of PRR-funded ocean initiatives, particularly those associated with the Hub Azul ecosystem, while exploring synergies with complementary programmes (Horizon Europe, PT2030, Mar2030).
5. Contributed to the reinforcement of the Northern Portugal Blue Economy ecosystem, supporting the emergence of the SUSTEMARE initiative and contributing to the consolidation of the PREI – Plataforma Regional de Especialização Inteligente, promoted by CCDR-N.
6. Continued the strengthening of international cooperation with the Republic of Korea, deepening collaborative initiatives in the ocean technology and maritime innovation domains.
7. Maintained active participation in the EU Atlantic Strategy, where INESC TEC continues to coordinate Pillar IV, contributing to the advancement of ocean knowledge, innovation, and international cooperation across the Atlantic basin.

8 RESEARCH AND DEVELOPMENT CENTRES

8.1 CTM - CENTRE FOR TELECOMMUNICATIONS AND MULTIMEDIA

Coordinators: Filipe Ribeiro and Vitor Grade Tavares

Presentation

The Centre for Telecommunications and Multimedia (CTM) has more than 100 core researchers contributing to Artificial Intelligence (AI), Bioengineering (BIO), Communications (COM), and Computer Science and Engineering (CSE) scientific domains (SD) of INESC TEC. The researchers are integrated across four operational areas: Optical and Electronic Technologies (OET), Wireless Networks (WIN), Multimedia and Communication Technologies (MCT), Visual Computing and Machine Intelligence (VCMI).

The centre and its operational areas are fully committed to the research and development of multidisciplinary technologies that integrate new expertise in Electronics and RF Engineering, Communication Networks, Multimedia, and Machine Perception. To this end, the centre activities are organised around five main research lines: optical, radio and electronics engineering (SD: COM, CSE), wireless networking (SD: COM), media platforms and audio-visual content management (SD: AI, CSE), computer vision and medical image analysis (SD: AI, BIO, CSE).

Research outcomes in 2025

The main broad research achievements obtained by CTM in 2025 were:

- A total of 150+ indexed publications, including 60+ articles published in relevant scientific journals, with more than 75% of them in Q1 journals;
- 5 PhD theses were successfully concluded;
- Awards: 6 FCT PhD scholarships (3 in non-academic environment), Best Oral Communication from the Symposium on Biomedical Engineering - DCE2025, Best Student Paper - BIBE2025. The SUPERIOT project was recognised by SNS JU as one of the Top 10 Key Achievements;
- Participation kick-off on 3 European projects (AGROBOOST, HURRICANE and POEMS) and 1 project in collaboration with NARLabs - Taiwan (AI-RBD).
- Events organised: INVICTA, a spring school of artificial intelligence, computer vision and pattern analysis, the SLICES-RI summer school on Hands-On 6G: Accelerating Innovation through Open Architectures and Advanced Testbeds. International workshops: 1 in EuCAP, 2 EUCNC & 6G-Summit, and 1 CSCN. National meeting in music research - ENIM.
- Participation in the DCIS, DSD, and PRML steering committees.

Electronics and Radio Engineering main research achievements:

- **RIS-based IoT Repeater Demonstrator:** A fully integrated Reconfigurable Intelligent Surface (RIS) prototype enabling dynamic beam steering based on real-time indoor localisation data. The system combines embedded beamforming control and system-level visualisation to enhance wireless coverage toward moving IoT nodes. (IEEE EuCAP 2025) [SD: COM].
- **Onset of dissipative solitons via modulational instability in nonlinear gradient complex Ginzburg–Landau systems:** Analytical and numerical characterisation of continuous-wave solutions of the cubic complex Ginzburg–Landau equation with nonlinear gradient terms, demonstrating their intrinsic instability and the emergence of stationary, oscillatory, and bound-state dissipative solitons through modulational instability mechanisms. (Chaos 35, 9 (2025)) [SD: Photonics]
- **Multi-level Co-simulation of RISC-V SoC and AI Accelerators:** Enabling automated interface generation between HDL simulations and high-level accelerator models, with functional and

cycle-accurate validation using AI inference workloads. The framework is open-source and under integration into the reference RISC-V SoC repository (MSc thesis - UP 2025) [SD: CSE].

Communications Networks main research achievements**:**

- **Context-Aware Rate Adaptation for Predictable Flying Networks:** Leveraging real-time link context to optimize transmission rates. (IEEE Networking Letters) [SD: COM].
- **Efficient Energy-Aware Multi-UAV Placement in Flying Networks:** Ensuring continuous ground user network coverage while minimising propulsion energy consumption. (Wireless Days 2025 and IEEE WONS 2025) [SD: COM].
- **Edge-Enabled UAV Swarm Deployment for Rapid Post-Disaster Search and Rescue:** Ensuring both communications and sensing performance by optimising UAV positioning and power allocation. (IEEE VCC 2025) [SD: COM].
- **Blockchain- and Semantic-enabled Underwater Communications:** Improving security and resilience of underwater networks. (OCEANS 2025) [SD: COM].

Multimedia and Machine Perception main research achievements:

- **Dialogue-attended Audiovisual Dataset:** A 280k video clips, each paired with a dialogue-based description, integrating data from existing benchmarking datasets. The dialogue is curated from both human-made captions and those generated by models pretrained on publicly available video and audio caption corpora. (ICBMI 2025) [SD: AI].
- **Methods for multimodal video classification and music generation:** A new approach for video analysis and classification relaying on the extraction of high-level features related to several modalities, intelligently fused to support different dimensionalities and temporal lengths. (IEEE TMM in press and PhD Thesis) [SD: AI].
- **Unified architecture for Visual Scene Description:** Unified and flexible architecture for complex visual scene understanding for 3D scene synthesis. (PhD. Thesis) [SD: AI, CSE].
- **Explainable AI-driven symbolic music information extraction:** Algorithms for computing harmonic-driven explanations from VAE representations of symbolic music. (IJPADM and AM & ICAD 2025) [SD: AI].
- **Two-Stage U-Net framework for Interactive Segmentation of lung nodules in CT scans:** A new framework based on the U-Net model that allows to correct such inaccuracies in an interactive fashion. (IEEE Access, vol. 13 (2025)) [SD: AI, BIO].
- **Efficient-Proto-Caps:** A parameter-efficient and interpretable capsule network for lung nodule characterisation, a lightweight and inherently interpretable model that combines capsule networks with prototype learning for lung nodule characterisation. (IEEE Access, vol. 13 (2025)) [SD: AI, BIO].
- **Explainable concept-based Large Vision Language Models for medical image classification:** obtained by grounding the final diagnosis on a set of predefined and human-interpretable concepts. (Comp. in Bio. and Med. vol. 198 (2025)) [SD: AI, BIO].
- **New model-agnostic method to compute saliency maps for classification models:** Relying on the Information Bottleneck principle to optimize masks to find meaningful regions on the input image for the model's decision. (Neurocomputing, Vol. 638 (2025)) [SD: AI].

Innovation outcomes in 2025

The main broad innovation achievements obtained by **CTM** in 2025 were the following:

- **Immersive XR platform for real-time interaction with distributed 5G/6G infrastructures:** Scalable architecture combining digital twins, private 5G connectivity, and reconfigurable radio environments to enable cross-border remote experimentation, monitoring, and adaptive control of next-generation wireless systems (Project: CONVERGE).
- **Transparent double-glazed window metasurface for enhanced indoor wireless coverage:** Patented transmissive metal-mesh metasurface integrated into standard double-glazed windows, enabling wavefront control at mid-band 6G frequencies while preserving high optical transparency. The solution enhances outdoor-to-indoor signal penetration, supporting sustainable smart-building connectivity (Project: SUPERIOT).

Communications Networks main innovation achievements:

5G Pilots validating the use of 5G cellular communications for industrial applications: Including the support for wearable sensors and edge-enabled secure and private data processing (Project: TESTBED5G).

Assessment of a cost-effective solution to estimate the 5G network performance of a Portuguese cellular operator: Based on the calibrated interpolation of field measurements (Project: 5GCover).

Multimedia and Machine Perception main innovation achievements:

- **Toolkit for beverage and food quality control:** The package includes a low-cost solution for mobile devices aiming at wine color analyses to detect degradation or adulteration of beverage and a label processing library for information extraction in unconstrained scenarios (Project: WATSON).
- **Multimedia emotion analyser:** the toolkit makes available a library of models able to analyse audio and video inputs and extract several high-level features, including emotion conveyed, detection of similarities in content and ironic discourse (Project; EADIGIFOLK).
- **Deep models that encode Unimodal Distributions for Ordinal Regression:** (1) UnimodalNet, a new architecture that by construction ensures the output is a unimodal distribution, and (2) Wasserstein regularisation, a new loss term that relies on the notion of projection in a set to promote unimodality.
- **BreLoAI-A Scalable Web Application for Breast Cancer Locoregional Treatment Approaches:** A web- based solution capable of integrating these algorithms as web services, thus offloading the computational resources to a centralised server (Project: CINDERELLA).
- **Integrating Automated Perforator Analysis for Breast Reconstruction in Medical Imaging Workflow:** into a Vendor Neutral Archive (VNA) workflow, leveraging the DICOM standard and widely used imaging platforms, Dicoogle, a VNA instance, and PACScenter, professional medical imaging VNA and viewer (Project: AVA).

Activity Overview

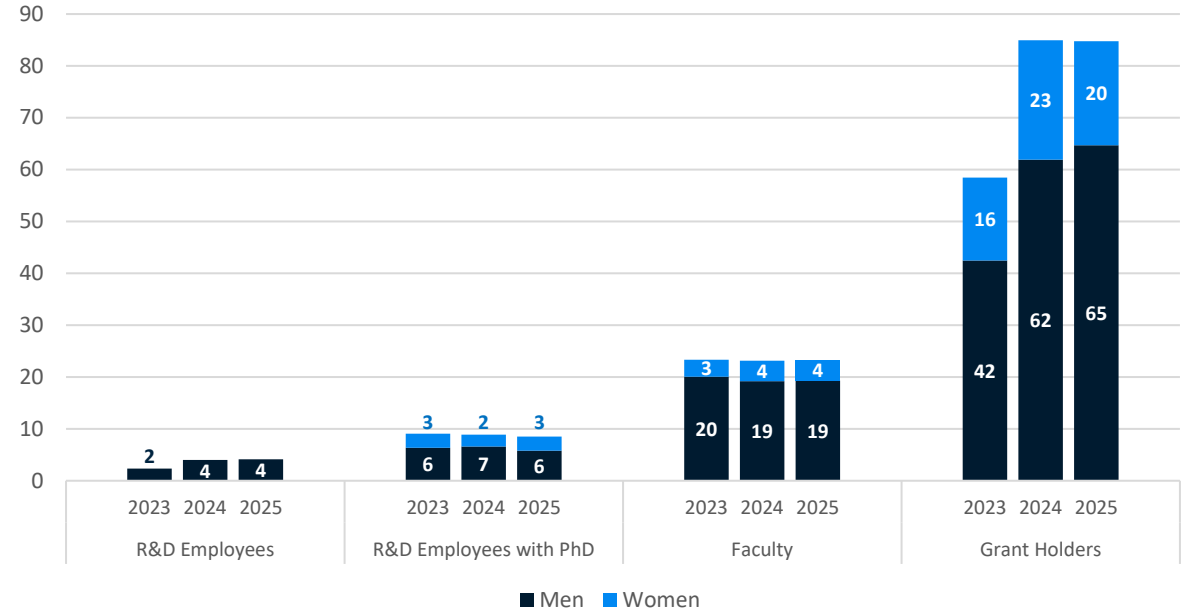


Figure 8.1 - CTM - Research team evolution (Person-years)

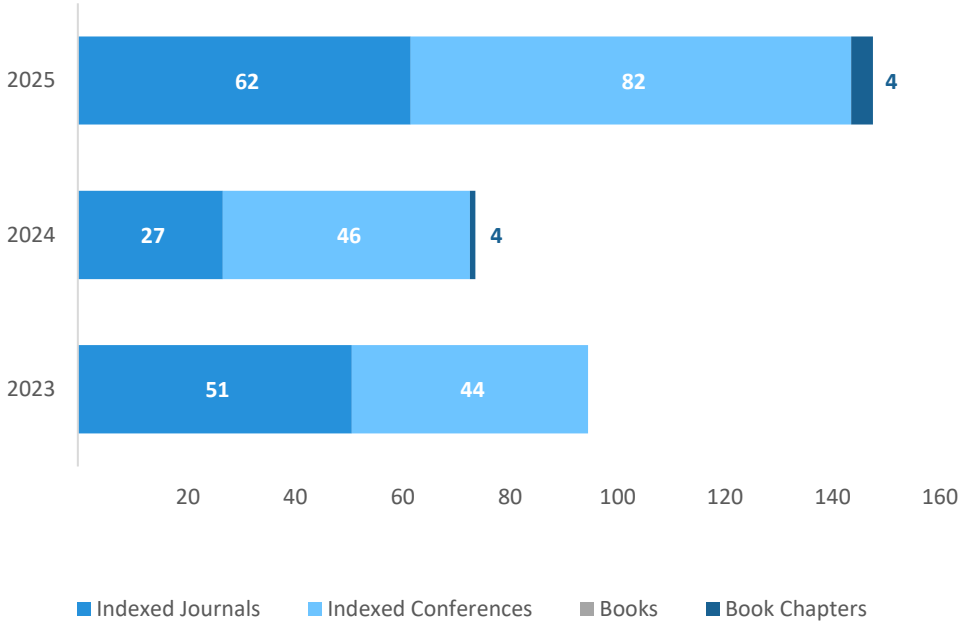


Figure 8.2 - CTM - Evolution of publications by members of the Centre (consolidated data)

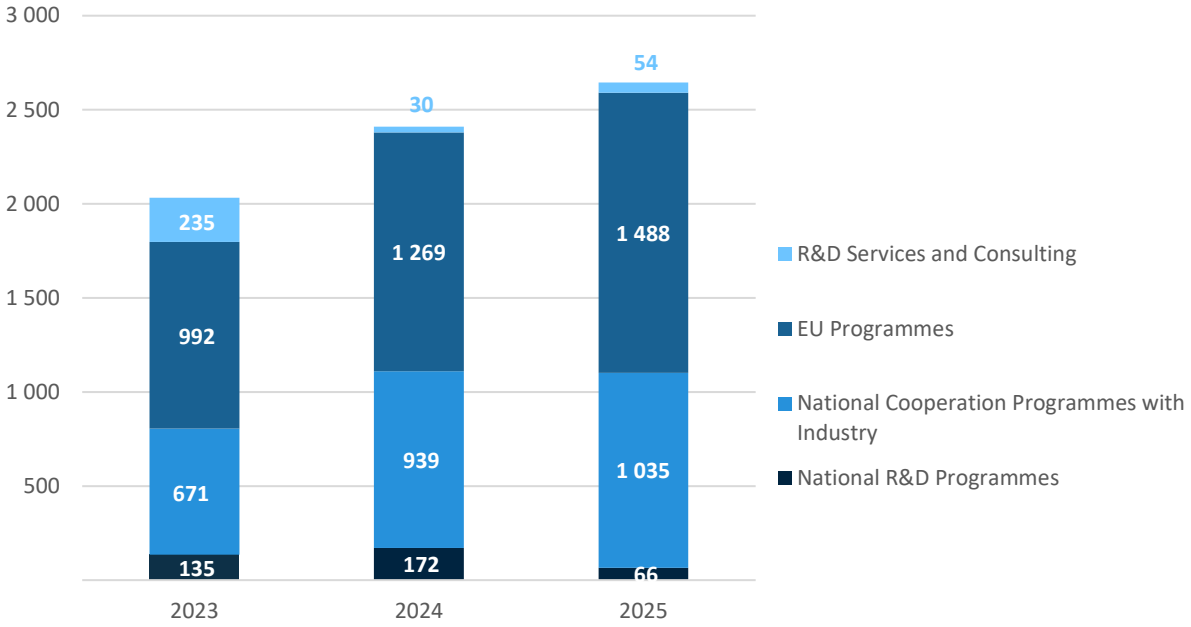


Figure 8.3 - CTM - Project funding evolution (k€)

8.2 CAP - CENTRE FOR APPLIED PHOTONICS

Coordinators: Luís Coelho and Paulo Marques

Presentation

CAP pursues its mission mainly in the Photonics Domain through a structured and strategic focus on four core research lines: integrated optics and microfabrication; optical sensing technologies, encompassing physical, chemical and biosensors; and quantum optical engineering. These research lines are strongly interconnected and foster a non-hermetic organisational model, promoting multidisciplinarity and synergistic collaboration across complementary areas of expertise. This integrated approach enhances the Centre's capacity to develop innovative, high-impact solutions addressing both fundamental and applied challenges.

A key strategic asset is the Centre's embedding within the DFA (Department of Physics and Astronomy of the Faculty of Sciences of the University of Porto), which hosts the Research Unit. This institutional integration strengthens scientific critical mass, optimises shared research infrastructures, and reinforces the link between research and advanced training. CAP plays an active role in supporting MSc and PhD programmes, particularly through advanced laboratory courses and research-based training, thereby contributing directly to the formation of highly qualified human resources and to the sustainability of the scientific ecosystem.

Research outcomes in 2025

On distributed sensing several tests were carried out on submarine cables and on suspended OPGW cables. For submarine cables, DAS technology was benchmarked against OBS systems, demonstrating equivalent performance and validating DAS with respect to conventional technologies. In addition, an algorithm for vessel identification was developed, based on the detection of boat signatures. Within the Submerse project, an automatic real-time vessel detection system was implemented. For OPGW cables, it was possible to detect high-voltage transmission towers and identify bird nests, associated with significant bird activity.

In the field of nanotechnology, significant advances were achieved in simulation capabilities and in the fabrication of high-quality photonic crystals, plasmonic-based sensing materials, optical filters on various substrates, and controlled alloy fabrication for multipurpose applications, paving the way for future sensing devices. This work was complemented by important progress in femtosecond-assisted two-photon absorption lithography, encompassing both numerical simulations and experimental validation.

In the area of biological and chemical sensing, several methodologies were investigated for the development of optical sensors and instrumentation to monitor concrete curing processes, enabling both local and remote measurements. The integration of optical and electrochemical sensing on the same substrate was validated, allowing electropolymerisation with real-time optical monitoring and high-precision measurements, pointing toward a future generation of integrated sensors. An autonomous algae-monitoring system was developed to collect data from multiple sensors and transmit it to a PLC system within the INNOAQUA project's central platform. Additionally, sensors and interrogation systems for hydrogen monitoring, combining optics and nanotechnology, and methane monitoring using spectroscopy-based methods were developed within the PRR ATE project, with plans for implementation in an industrial demonstrator.

In the field of quantum technologies and spectroscopy, relevant advances include the development of a Hong-Ou-Mandel microscopy setup and the deployment of an industry-grade LIBS-based prototype for the identification of the contaminants in recycled wood (PRR TRANSFORM). Besides, in the field of optical computing and information processing, the design of Fisher information enhanced sensing strategies and speckle-based multipoint acoustic sensing solutions established ground-breaking scientific directions which will be further developed during 2026.

On integrated optics and microfabrication, integrated optic modulators on glass were demonstrated by femtosecond laser direct writing. Laser direct writing was used to produce the waveguides in borosilicate glasses and the thermal shifters (electrodes definition by metal laser ablation). The production of low loss

waveguides was demonstrated using multi-pass laser writing and thermal annealing processes. An optofluidic platform was demonstrated based on femtosecond laser micromachining of glass capillaries, and as a result an international patent was filed.

Innovation outcomes in 2025

Software for vessel detection - Developed software to automatically detect vessel activity from sensing data, from signal processing to classification. Validated the approach for operational monitoring and near real-time alerting.

FanoiFBG - Advanced FanoiFBG technology through design iteration and experimental validation. Improved robustness and performance, moving it closer to field-ready integration.

Mitigating the Vernier effect limitation (general-purpose solution) - Implemented a general strategy to reduce Vernier-effect constraints, improving usable range and reliability. Enabled a more scalable solution with lower sensitivity to drift and easier deployment across scenarios.

Speckle-based multipoint sensing using data-driven interrogation - A new solution for multipoint acoustic sensing using event-based cameras was developed and demonstrated in the laboratory, resulting in a patent application (P2022.6).

During 2025 several patent applications were prepared and submitted. Namely:

System for passive optical monitoring of gas concentration and physical parameter and operation methods thereof (P1941.6). A passive optical system for multi-point gas monitoring uses a laser interrogator and fibre splitters to send pulsed signals through uniquely delayed fibre lines to mirrored gas sensors, with gas presence determined from attenuation in the returned signals.

System and method for concomitant measurement of pressure and concentration of methane, and system thereof (P2001.3, EP 25191371.1). A system and method for simultaneously measuring methane pressure and concentration use modulated laser signals transmitted via fiber optics to a gas absorption sensor, with reflected signals converted to electrical signals and analysed based on absorption characteristics.

Fiber optic sensor for hydrogen plasmonic sensing and interrogation system thereof (P1989.0, EP 25175553.4). An optical sensing device for dual measurement of temperature and relative humidity in cementitious material, using an optical fiber with a hydrophilic polymer Fabry–Perot cavity for humidity sensing and an inscribed Fiber Bragg Grating for temperature sensing, housed in a vapor-permeable, liquid-impermeable chamber.

Optical fibre sensor for structural health monitoring of reinforced concrete structures, methods and uses thereof - (P2011.4, EP25218932.9) - An embedded fibre sensor bundle for reinforced concrete structures, including the detection of curing, water ingress, carbonation, humidity, and corrosion through reflectance and refractive index changes to assess structural integrity.

System and method for fiber optical relative humidity and temperature sensing and uses thereof-Multipurpose Fiber Optic Sensor for Temperature and Relative Humidity (P2002.4). An optical fibre sensing device for simultaneous temperature and relative humidity measurement in concrete, using a hydrophilic polymer–based Fabry–Perot cavity and an inscribed FBG, enclosed within a vapor-permeable, liquid-impermeable chamber.

Optoelectrochemical device for detection of analytes and in situ electrochemical functionalisation, and method thereof (P2004.4) - An optoelectrochemical device that enables analyte detection and in situ electrochemical functionalisation in liquid samples, integrating a plasmonic thin-film substrate that serves as both a working electrode and surface plasmon excitation element within a fluidic reaction chamber.

Optofluidic device on a glass capillary tube, PCT/IB2025/059839 filed on 30.09.2025 (Priority PT 119727 (30.09.2024) and EP EP24213413 (15.11.2024). The disclosure relates to an optofluidic device fabricated from a capillary glass tube machined for the insertion of optical fibres for different types of measurements.

Activity Overview

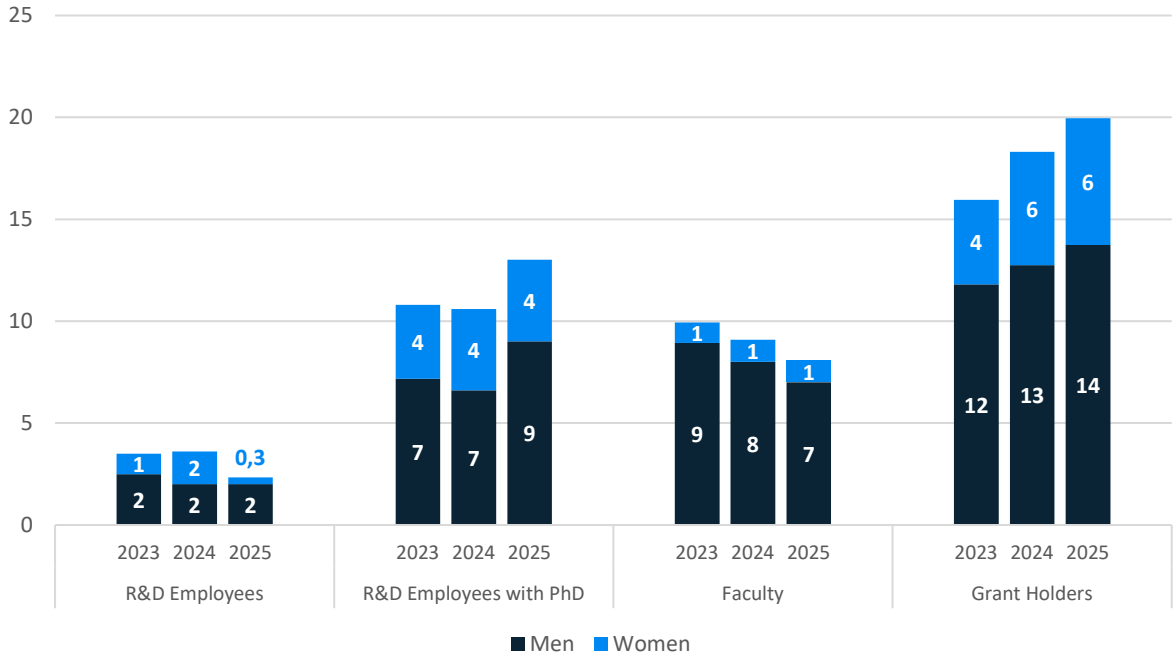


Figure 8.4 - CAP - Research team evolution (Person-years)

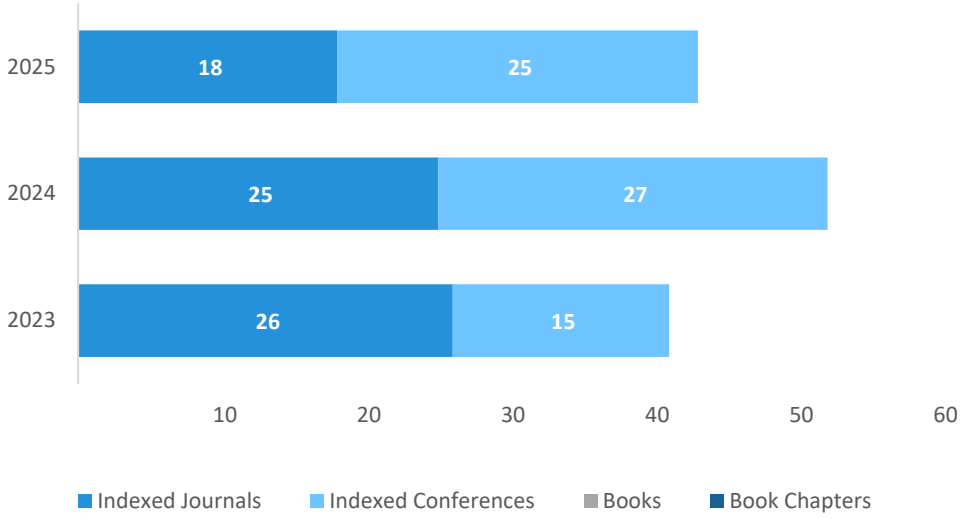


Figure 8.5 - CAP - Evolution of publications by members of the Centre (consolidated data)

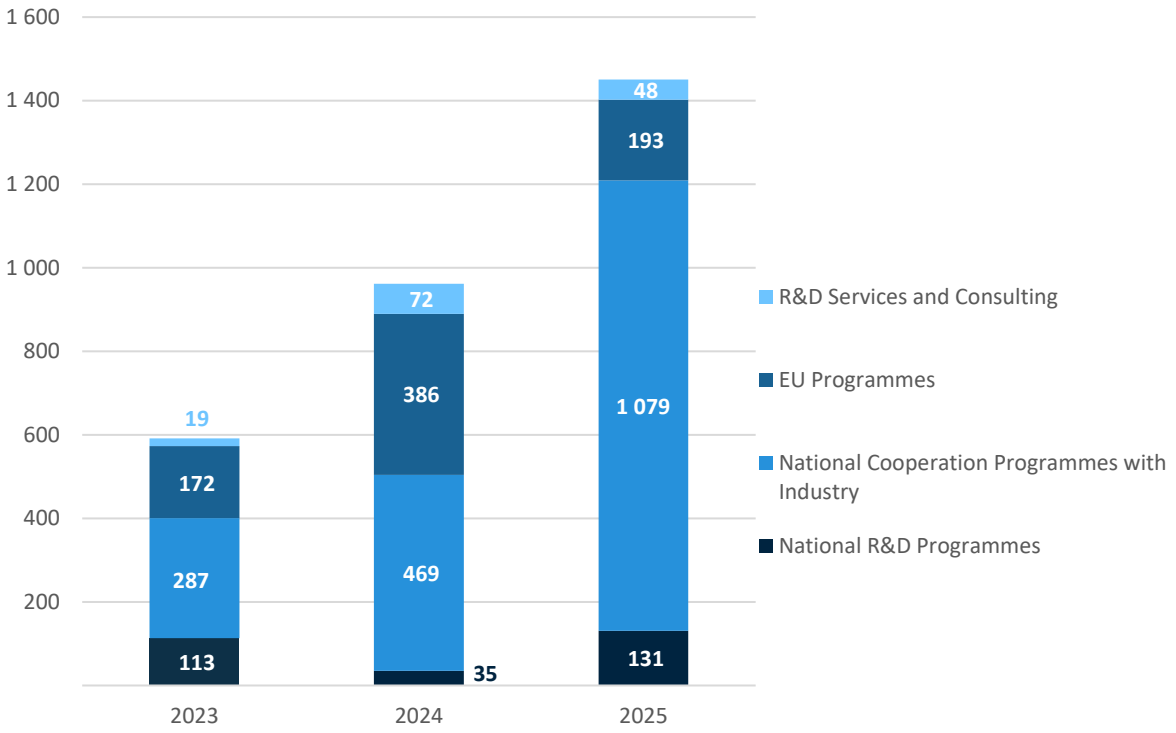


Figure 8.6 - CAP - Project funding evolution (k€)

8.3 CRAS - CENTRE FOR ROBOTICS AND AUTONOMOUS SYSTEMS

Coordinators: José Miguel Almeida and Nuno Cruz

Assistant to the Centre Coordinator: Bruno Fernandes

Presentation

The Centre for Robotics and Autonomous Systems (CRAS) brings together more than 100 researchers working on scientific and technological topics related to field robotics and autonomous systems. CRAS aims to be a global benchmark in the field of robotics and autonomous systems. It is already internationally recognised for its innovative robotic solutions for operating in complex environments – notable examples include underwater and deep-sea environments – as well as for developing advanced robotic technologies and systems that integrate autonomous aerial and terrestrial platforms.

CRAS has a unique scientific focus on multi-sensor perception, navigation, positioning, and sensor fusion competencies. CRAS fulfils its mission by directing its activities towards four main research areas: navigation and control (RL1), interaction with the environment (RL2), perception and mapping (RL3), and platforms and operations (RL4).

CRAS's activities are mainly at TRL levels 5-8, associated with the design, development, and integration of robotic platforms with increasing autonomy. These activities have contributed to deploying innovative solutions in multiple fields of application, such as security, protection and defence, underwater mining, environmental monitoring, deep sea exploration, and infrastructure inspection. These activities are organised into four innovation topics: prototyping and scaling up robotic systems (INOV1), navigation and mapping (INOV2), development of components for robotic systems (INOV3), and underwater acoustics for positioning, navigation, and communications (INOV4).

Research outcomes in 2025

In 2025, the Centre participated in 41 research projects across all research lines, with 17 new projects launched during the year, ensuring continued funding of its core activities. To support this large number, the team expanded to over one hundred researchers, alongside an increase in R&D contracts (now over 40). The year concluded with one completed PhD thesis and several others nearing completion.

A major milestone was the organisation of the combined IFAC flagship symposia: ROCOND'25 on robust control design and LPVS'25 on Linear Parameter Varying Systems, which gathered over 100 participants. The focus on research, theoretical and practical advances in robust control, is fundamental for systems to be capable of functioning reliably in the face of uncertainties and variations in real application scenarios.

The Centre maintained a strong quality publication record, with all journal papers published in Q1 and Q2 journals (over 60% in Q1). One article has been presented at the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2025), a flagship conference in robotics. CRAS members remained active in editorial boards of prestigious publishers and in organising committees of international conferences and workshops. International recognition was reflected in invited talks, visits to partner institutions, and the hosting of international researchers. In summer 2025, the Centre welcomed six foreign university students for volunteer research internships, selected from a large pool of applicants.

Main scientific results achieved in 2025:

- A novel method for direct extraction of three-dimensional planar surfaces from two-dimensional imaging sonar acoustic data, exploiting beamwidth-induced secondary echoes and an inverse sensor model to estimate plane inclination, height, and width without point-cloud conversion. The approach was validated in controlled experiments and with data from a real hydroelectric dam shaft, demonstrating its potential for plane-based underwater SLAM and inspection (RL2; RL3). Work published at IROS 2025.
- A real-time GPU-parallelised implementation of a probabilistic 3D underwater scan-matching method (3DupIC), enabling efficient registration of sonar-derived point clouds under onboard computational constraints. The approach introduces reusable matrix-based parallel kernels and

was experimentally validated on the EVA AUV, supporting robust localisation and mapping in real underwater operations (RL1; RL3). Work published in MDPI Robotics.

- A multimodal perception and sensor-fusion system for precise autonomous UAV landing in offshore environments, integrating visual, thermal, and LiDAR data through a transformer-based deep learning architecture. The system achieved centimetric-level pose estimation accuracy and was validated in real-world offshore wind farm operations (RL1; RL3; RL4). Work published in the Journal of Field Robotics.

Innovation outcomes in 2025

At the beginning of the year, INESCTEC.OCEAN was officially launched – a project with a strong expected impact on INESC TEC and the Centre's ocean-related initiatives. This Centre of Excellence aims to advance research and engineering in ocean-related areas, such as marine structures, underwater robotics, ocean energy, and marine data analysis, from an integrated science-and-technology perspective.

Throughout the year, the most relevant innovation outcomes were highlighted in several dissemination events:

a) Dissemination at technology discussion events:

- INOVARMY - The 4th edition of the Army's Innovation and Technological Modernisation Event - An event focused on innovation and technological modernisation organised by the Portuguese Army, dedicated to strengthening cooperation between military forces, industry, academia, and research centres, with a focus on the present and future of technology applied to national and international defence.
- Stakeholder Forum in Ocean Engineering – On 28 January 2025, CRAS contributed to the organisation of a Stakeholder Forum for the INESCTEC.OCEAN Kick-off Meeting. The stakeholder discussion panels focused primarily on the areas of Ocean Energy and Data, including topics such as offshore renewable energy and the monitoring of human activities at sea.

b) Presentation of CRAS technologies and solutions, with stands at relevant robotics events:

- ERF 2025 – The 16th edition of this annual forum, organised by euRobotics - One of the leading European events in the fields of robotics and artificial intelligence, held in Germany. CRAS was present with an exhibition stand, where it showcased technologies developed in-house. Among the projects presented, Drivolution and Seaguard stood out.
- REPMUS 2025 – The 15th edition of the world's largest international exercise in robotics and autonomous maritime systems, held in Portugal. For almost three weeks, experimental scenarios and real operational tests were carried out at sea, covering topics such as the protection of critical underwater infrastructure and underwater rescue operations. CRAS made an important contribution and used autonomous vehicles in various locations and visual inspection tasks.
- WAVES 2025 - The third edition of WAVES 2025 - Technical-Scientific Meeting held in Ponta Delgada (Azores), Portugal, focused on the use of advanced technologies to explore and monitor the sea. The focus is on intelligent maritime technologies, especially underwater vehicles and systems used in marine science, surveillance, security, and environmental protection. CRAS participated as a technical and research partner, contributing to the discussion on intelligent robotic systems for maritime use.

c) Inviting organisations and representatives from targeted sectors to visit our laboratories to showcase our technological solutions:

- Visits of representatives of Public Organisations - We highlight the visit by the President of the National Monitoring Committee for the Recovery and Resilience Plan (PRR)2, to whom we presented some of the new PPS being developed for the Portuguese PRR.
- Visits of companies and representatives of industrial sectors – More than fifteen events throughout the year where visitors attended demonstrations, exhibits, and technical talks.

Activity Overview

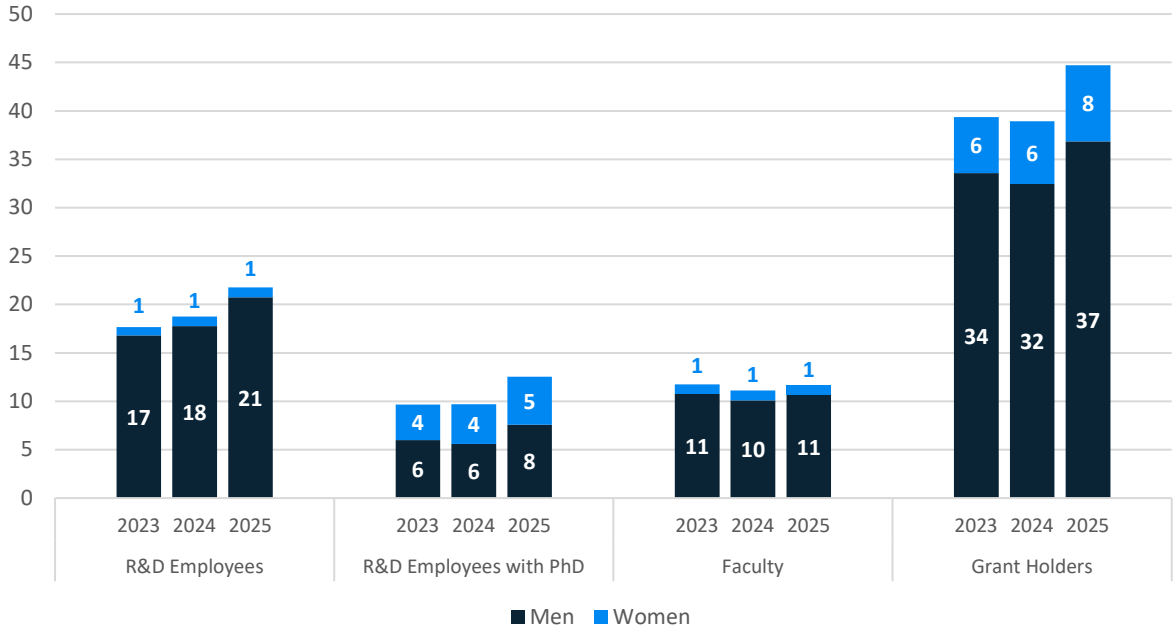


Figure 8.7 - CRAS - Research team evolution (Person-years)

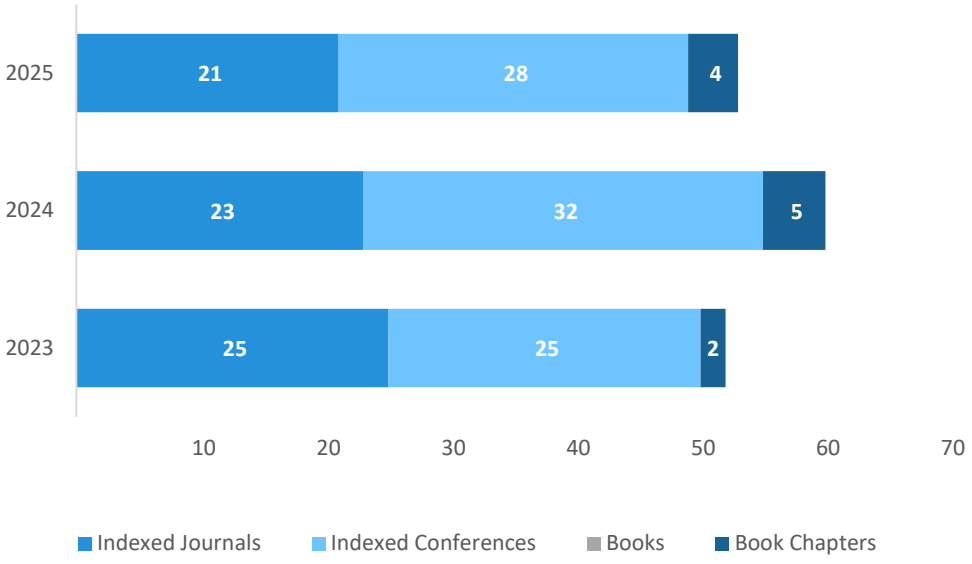


Figure 8.8 - CRAS - Evolution of publications by members of the Centre (consolidated data)

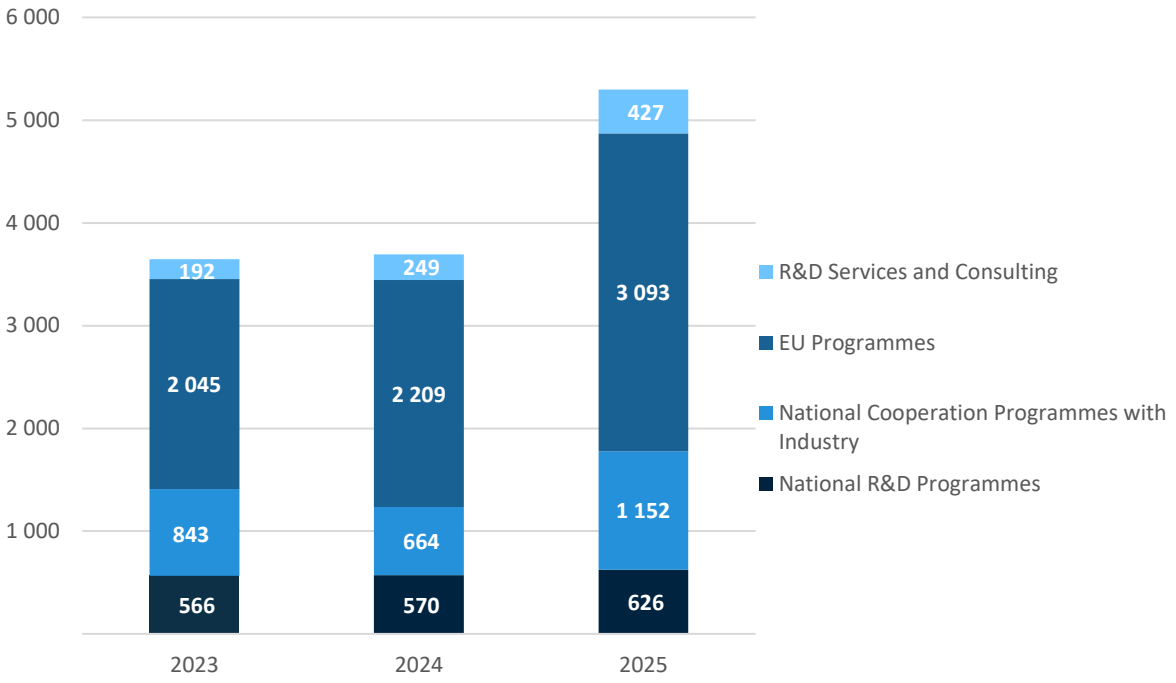


Figure 8.9 - CRAS - Project funding evolution (k€)

8.4 C-BER - CENTRE FOR BIOMEDICAL ENGINEERING RESEARCH

Coordinator: João Paulo Cunha

Assistant Centre Coordinator: Duarte Dias

Presentation

The Centre for Biomedical Engineering Research's (C-BER) main objective is "to promote scientific knowledge excellence through fundamental and applied research, advanced training and innovation in Biomedical Engineering". Mainly focused on the Bioengineering domain, C-BER has a high level of multidisciplinary among its researchers, leading to research on other INESC TEC domains, such as Artificial Intelligence, Photonics and Robotics. To accomplish its mission, C-BER is organised into three Labs (Biomedical Imaging Lab, BioInstrumentation Lab and NeuroEngineering Lab), and is guided by the following strategic goals:

- **To create interdisciplinary knowledge** enabling innovation and technology transfer with economic impact;
- **To develop bioengineering** methods, products and tools for the prevention, early detection and diagnosis of different types of diseases, aging-related impairments, rehabilitation, occupational health and wellness;
- **To contribute** to the development of advanced **neuro-technologies** at the frontier of engineering and neuroscience;
- **To promote** internal **synergies** and strategic **partnerships** with other Centres of INESC TEC, clinical partners, research institutes, medtech companies & startups and foster international cooperation.

Research outcomes in 2025

Organisation, human and material resources: During this year, it was possible to maintain the number of employees although there was unexpected rotation that leads always to extra overhead on onboarding and familiarisation with the project and the related partners. In 2025, C-BER was able to get approval on several new national project due to due the huge effort made in 2024, with new 5 FCT project and 2 P2030. Combining these projects with the existing ones and some services provided, C-BER was able to keep a diverse portfolio of projects towards a sustainable funding for R&D. A huge effort was also made in the submission of new international project (Horizon Europe) the creation of new international networks that are expected to result in future approved projects. A landmark for C-BER in 2025 was reaching the 1M€ of total income. This shows high commitment from all the members and an increment on the number of projects and high impact R&D activity.

Publications: From 2024 to 2025, C-BER was able to achieve its goal on maintaining the publication level at Journals with 25 published journals. Some of these high-impact papers are worth mentioning since they are the result of a strong partnership with the clinical teams that are cooperating with our centre in several research lines.

A publication reporting our research on early MRI biomarkers for identifying the cerebral small vessel disease in its asymptomatic stages triggered by hypertension that impacts the brain's white matter and blood flow regulation was the Editor's Choice for the COVER of Elseviers' scientific journal Neuroscience (the official journal of the International Brain Research Organisation (IBRO) - https://doi.org/10.1016/j.neuroscience.2025.06.017). The paper "Exploring image and skeleton-based action recognition approaches for clinical in-bed classification of simulated epileptic seizure movement" was published at the Top#1 scientific journal in Artificial Intelligence (Google Scholar) - Expert Systems with Applications, from Elsevier.

During 2025 a major landmark was obtained on Computer-Aided Gastric Evaluation research line, with automatic EGGIM estimation reaching clinically relevant results for a single centre, resulting in a total of 10 publications, 2 on them in Endoscopy Journal, which is the leading top journal in gastrointestinal

endoscopy, with an impact factor of 12.8. The first paper is focused on using artificial intelligent for endoscopy grading to support risk cancer analysis (https://doi.org/10.1055/s-0045-1805180) and the second on stratification (https://doi.org/10.1055/a-2657-9906).

Internationalisation: The strong internationalisation effort from previous years is now showing its results. In the multiscope research lines, C-BER will participate on a large clinical study that will be at Brazil – our data acquisition Application will be integrated in the clinical study system to collect data and synchronised directly with the overall study data. Also, in the research line, C-BER hosted 1 postdoc via INESC TEC International Visiting Researcher Program, 1 MSc thesis student from Politecnico di Torino and 1 MSc student from University of Aalborg. On the Neuroengineering area, a new CMU-Portugal PhD student from C-BER is preparing his journey to CMU at the Robotics Institute where during the year of 2026 will be co-supervised by Prof. Doug Weber on new synchronisation methods for physiological multimodal and multisystem data acquisition.

Dissemination Actions: In 2025, C-BER members and IEEE EMBC Portuguese branch chairs organised the IEEE ENBENG 25 in Aveiro, with 54 attendees from 6 countries. During this year of 2025, key milestone was achieved: C-BER senior researchers were able to attract one of the IEEE EMBC flagship conferences - IEEE Body Sensor Networks (BSN) - to be held in Porto, Portugal in October 2026. During 2025, C-BER members continue the organisation of an INESC TEC internal scientific event, named BioBytes – the objective is to have a social lunch for scientific brainstorming after a keynote speaker presentation, allowing to have an informal discussion about the topic, sharing knowledge and creating possible synergies.

Innovation outcomes in 2025

WeFetal Technology: A prototype system from our lab to detect, quantify, and locate fetal movements in real-time at home, received a **BIP PROOF prize** from University of Porto to support its further development and perform a validation clinical study.

Innovation Infrastructures: According to the C-BER plan to improve Laboratories' infrastructures, in 2025, C-BER equipped the BRAIN-Stim Lab with an fNIRS system. This new system will be synchronised with all the acquisition system on the laboratory, namely the video-EEG Micromed system, allowing to create a cutting-edge multimodal brain data acquisition for studying different brain paradigms and can be reproduced in the Hospital for clinical research.

Patents & IP Creation: C-BER continued filling the patent pipeline in 2025. As a result of those actions, C-BER has 2 new patent applications and 1 internationalisation (RePick technology). Our strong commitment to exploit our technology led to the creation of one more commercial contract and at least 3 more are expect for 2026.

Activity Overview

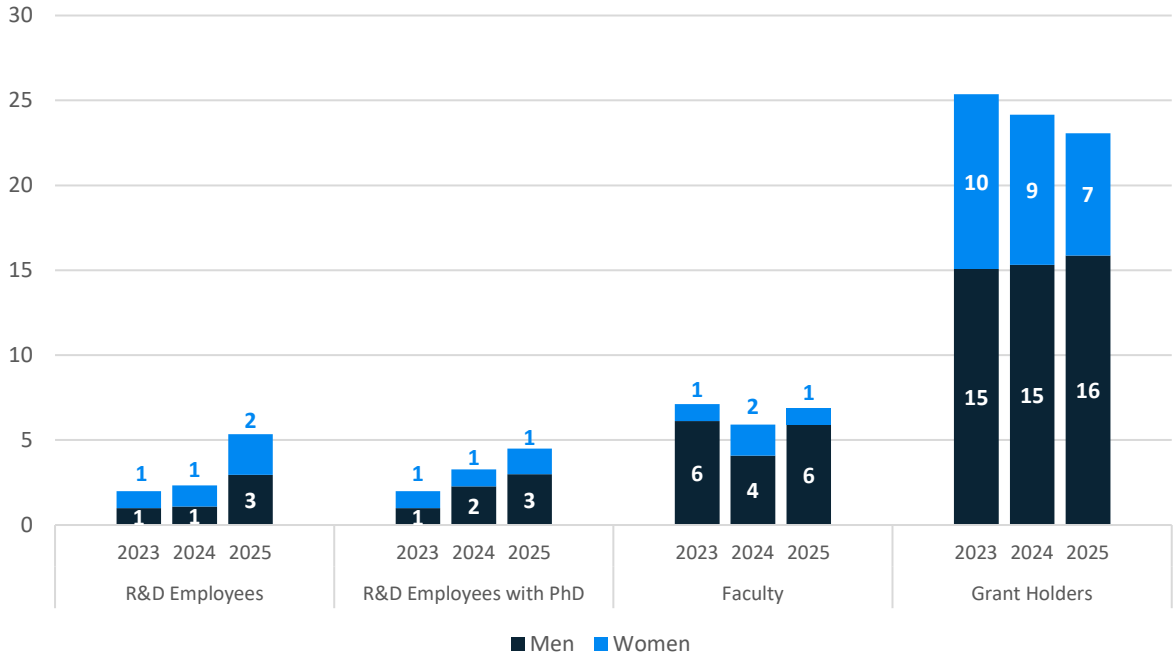


Figure 8.10 - C-BER - Research team evolution (Person-years)

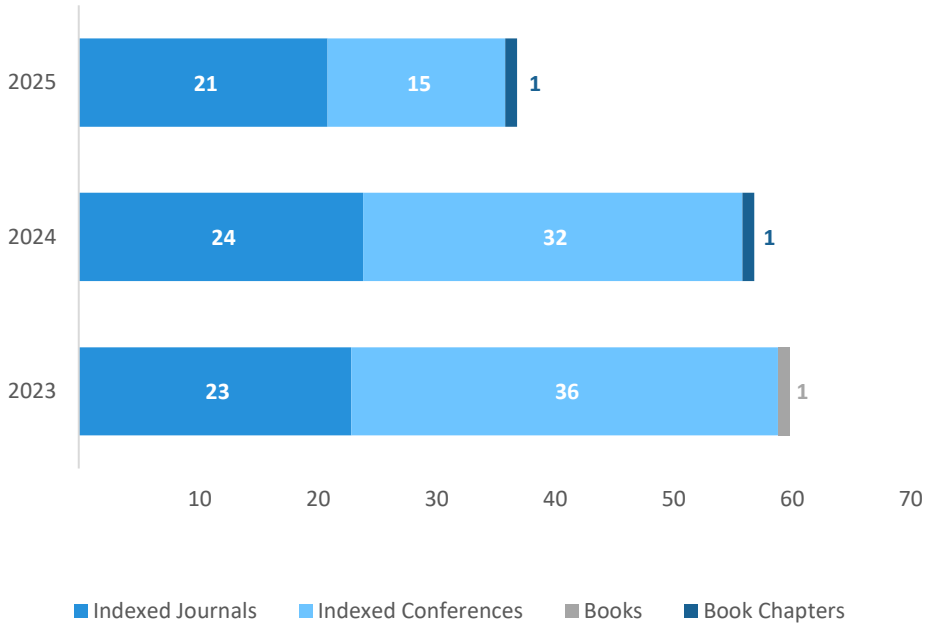


Figure 8.11 - C-BER - Evolution of publications by members of the Centre (consolidated data)

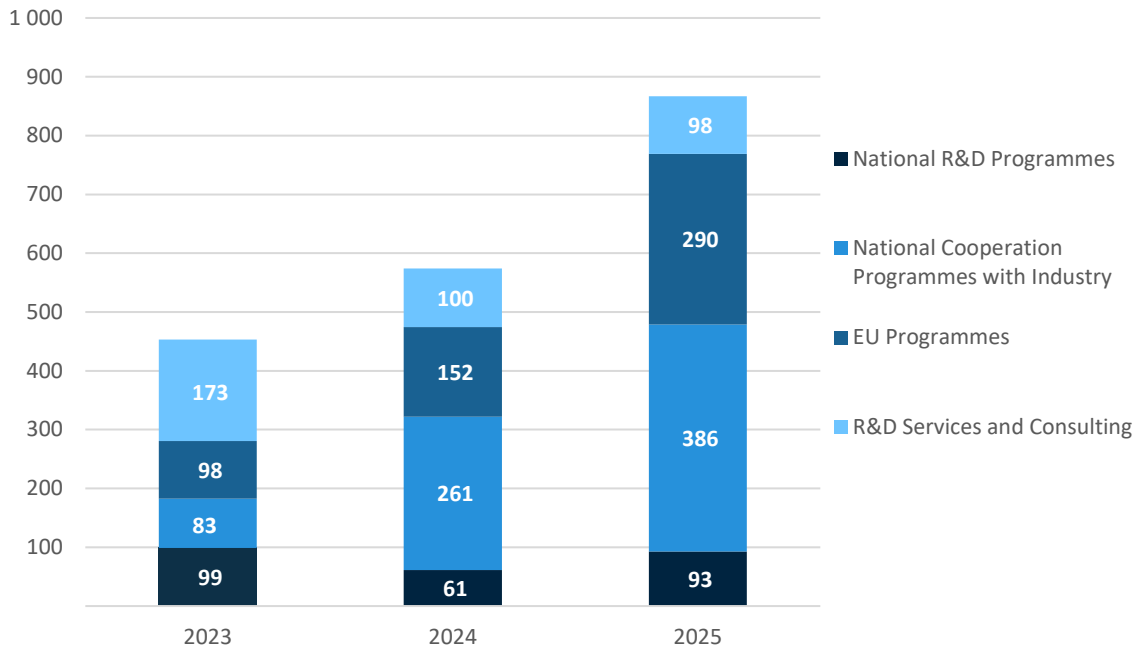


Figure 8.12 - C-BER - Project funding evolution (k€)

8.5 CPES - CENTRE FOR POWER AND ENERGY SYSTEMS

Coordinators: Manuel Matos and Ricardo Bessa

Assistant to the Centre Coordinator: Catarina Oliveira

Presentation

CPES supports the energy transition, leading to reductions in greenhouse gas emissions through the decarbonisation of the energy system, large-scale integration of RES in isolated and interconnected power systems, the electrification of society, and increased energy efficiency. This involves the combination of model (physical) and data-driven methods for modelling and optimising energy systems, leveraging emerging technologies like artificial intelligence, data spaces, and interoperability. Results include concepts, models, methodologies, and (closed- and open-source) software tools useful for addressing the decision-making problems of citizens, communities, multi-energy utilities, system operators, regulators, policymakers, and government bodies.

Research outcomes in 2025

In 2025, our research delivered major advances across electricity markets, multi-energy systems, power electronics, and grid resilience, combining methodological innovation with strong publication outcomes.

In electricity markets, we proposed an algorithm-based framework for local flexibility markets grounded on distribution grid segmentation. The approach enables grid-aware technical clearing and zonal aggregation of flexible resources while avoiding the DSO disclosing detailed grid topology to service providers. This work was published in Utilities Policy. In parallel, a joint electricity and hydrogen markets simulation model was upgraded to incorporate contract models for both commodities, enabling impact assessment under perfect competition and Cournot settings (Int. J. Hydrog. Energy). We also introduced a multi-objective optimisation framework for energy sharing in energy communities with shared facilities, integrating people-flow data modelled through the Social Force Model into energy management strategies to improve efficiency and sustainability (IEEE Trans. Smart Grid).

Research on dynamic tariffs and demand-side management was strengthened through several contributions focused on electric mobility. We developed an explainable, carbon-aware EV charging optimisation approach, including the concept of emission budgets under uncertainty for charging stations (Applied Energy). We further applied double machine learning to perform causal analysis of the impact of dynamic tariffs on EV charging behaviour (Energy). Complementarily, EV charging management was addressed through data-driven strategies to mitigate battery degradation (IEEE Access).

A multi-objective energy management tool was developed to enhance renewable integration in hybrid offshore power plants, explicitly accounting for connection limits imposed by existing cable circuits (Applied Energy). In addition, for renewable energy data valorisation, we proposed a bidding mechanism within a data and analytics market to ensure fair compensation for data providers while enabling buyers and sellers to express price requirements (IEEE Trans. Sust. Energy).

In multi-energy systems, particularly in green hydrogen integration, several achievements have been made. First, we developed a power converter and control strategy for integrating hydrogen electrolysers into electric grids, including ancillary service provision capabilities (Int. J. Hydrog. Energy). Second, we proposed an optimisation-based approach to evaluate hydrogen as a coupling option for offshore hybrid power plants (Sust. Energy, Grids Netw.). Third, we designed a mathematical model to optimise natural gas distribution grids with multi-node hydrogen injection, adjusting injected quantities to satisfy pressure constraints, gas flows, and quality indices (Sust. Energy, Grids Netw.).

Grid-forming (GFM) converters were another major highlight. These technologies enable power-electronic resources to actively regulate voltage and frequency, making them essential for stability in low-inertia, renewable-dominated systems. We developed a methodology for GFM placement that integrates up to four stability indices into a single heuristic optimisation problem (IET Gen. Transm. Distrib.). This was extended to jointly optimise location and sizing using a bi-level strategy that combines Bayesian Optimisation with gradient-based methods (Int. J. Electr. Power Energy Syst.). We also proposed GFM sizing approaches enabling autonomous black start of isolated offshore wind farms within energy islands (Sust. Energy, Grids

Netw.). Furthermore, an automated control design framework based on simulated annealing was demonstrated on a GFM converter, evolving graph-based controller structures to generate robust solutions that improved stability and outperformed benchmark configurations (Sust. Energy, Grids Netw.).

In cyber-resilience, we addressed emerging threats by modelling UAV-based cyberattacks on microgrid operations. A multi-objective optimisation framework was proposed to maximise attack duration, disruption impact, stealth, and energy efficiency (IEEE Trans. Ind. Appl.).

Beyond technical developments, we contributed forward-looking research directions. Three conceptual papers were published: (a) an international collaboration outlining challenges and requirements for effective human–AI interaction from an interdisciplinary perspective (iScience); (b) a risk management framework using spatio-temporal metrics and optimisation-based risk reduction (Sust. Energy, Grids Netw.); and (c) an analysis of load forecasting challenges for port decarbonisation and the role of port authorities in fostering collaborative, data-driven ecosystems (Transport Policy).

Regarding research infrastructure and impact, the Centre released 49 open-source software assets on GitHub (11 more than in 2024), including two projects under Linux Foundation Energy: Semantic Energy Framework and CUPID (Controllable Unit Protocol Interface for DER).

Finally, several distinctions recognised the excellence of our researchers. Ricardo Bessa and Hermano Bernardo were elevated to IEEE Fellow and IEEE Senior Member, respectively. Luís Rodrigues received the Vestas Award for the best master's thesis on monetisation strategies for privacy-preserving collaborative forecasting with blockchain support.

Innovation outcomes in 2025

Software development activities significantly advanced energy system optimisation, flexibility integration, and grid operation tools.

The RECreation platform for energy community management was enhanced to enable participation in DSO-led flexibility markets through interoperable integration with the GDBN (Grid Data and Business Network) platform, supporting coordinated interaction across the flexibility value chain (published in Current Sustainable/Renewable Energy Reports). Its energy management system was upgraded with advanced optimisation algorithms to dispatch cross-sector flexible assets - including electric vehicles, heat pumps, HVAC systems (published in EEM 2025; EEEIC/I&CPS 2025), and power-to-hydrogen units. The planning module was further improved through clustering-based scalability techniques and inclusion of flexibility revenues (published in EEM 2025). The CEVESA Iberian electricity market simulation software evolved substantially during 2025, notably incorporating battery participation in automatic frequency restoration reserve (aFRR) markets based on streak modelling, coordination of energy and aFRR capacity across single price areas, and in-depth calibration with 2023 market data.

FlexiHome (formerly HEMS, developed under InterConnect project) was redesigned with two major improvements. First, a hybrid edge-to-cloud architecture reduced dependency on manufacturer rate limits while increasing computational autonomy and interoperability. Second, Generative AI microservices were introduced to enhance the explainability of appliance optimisation decisions.

A novel low-voltage grid management prototype integrating state estimation, dynamic operating envelopes, and voltage control was developed and exposed via RESTful APIs. Corporate e-mobility solutions were also delivered, integrating EV fleet charging and energy optimisation into a unified management platform.

An OPF-related reusable Python package implemented a novel multi-period security constraints optimal power flow formulation using nonlinear programming with penalised slack variables and targeted constraint relaxations, preserving full AC physics and N-1 security while improving tractability.

Advanced Protection, Automation and Control applications for MV networks included an adaptive protection system, anomaly event detection, and automatic voltage regulation. Adaptive protection combines regime clustering, settings optimisation, anomaly-aware classification and online decision support (published in IEEE PowerTech 2025).

Industrial optimisation solutions included a PCM-enhanced cold-warehouse algorithm coordinating compressors, PV and market participation, reducing costs and compressor usage while improving thermal stability (1-year validation; deployment at Sonae).

For electrified maritime ports, physics-based demand models were developed for electric cranes, refrigerated containers and onshore power supply. These supported demand response via reefer thermal inertia, crane scheduling under dynamic prices (published in EPIA 2025), and onshore power supply peak shaving (published in EFEA 2025).

Predico, a SaaS multilateral collaborative forecasting platform, was operationalised. A proof-of-concept for Elia (Belgian TSO) achieved up to a 14% improvement in accuracy for offshore wind and solar forecasting.

A patent (P1710.0 EP) was submitted for an optimised EV charging and fleet management MILP method that co-optimises fleet charging, PV+BESS dispatch, and charger allocation under operational constraints.

In terms of energy data management and interoperability, the OASIS platform was developed as the local RES Node of EnerTEF testing and experimentation facility, integrating NLP capabilities through a local LLM and the CHRONOS2 foundation model. It supports four AI services: data imputation, encryption, forecasting and advanced visualisation. The SEMAPTIC web tool was created to support semantic mapping and interoperability.

Significant advances were achieved in EV charging and DER integration hardware. An in-house AC charging infrastructure was integrated with a proprietary Charging Station Management System using OCPP 2.0.1, enabling secure communication, smart charging, interoperability, ISO 15118 support, and advanced monitoring. A bidirectional DC charger for LVDC microgrids was developed in compliance with IEC 61851-23, following a Current/OS control framework. An EV emulator was also built to validate the charger and strengthen X-energy laboratory testing capabilities.

DERway, a protocol-conversion gateway for inverters, batteries and EV chargers, enables interoperability with IEEE 2030.5 and OpenADR. MeterLink, a domestic dongle-format smart meter, enables the acquisition and transmission of processed measurements to the cloud.

Low-voltage ride-through and reactive power services for hydrogen electrolysers were implemented through a complete AC/DC/DC chain and novel control schemes (presented in IEEE PowerTech 2025), with the full solution submitted for patent protection.

In terms of consultancy for industry departing from R&D results, extensive PMU-based simulation studies were conducted for AELEC, analysing the April 28, 2025, Iberian blackout. Dynamic cogeneration models were developed for grid-code compliance and stability assessment. The RECEP tool was updated to compute renewable reception capacity in the Portuguese transmission grid. Industrial R&D services for GE Vernova delivered an integrated real-time simulation and automation toolchain, demonstrated publicly (DistribuTECH 2025). The solution integrated transmission and distribution models into digital real-time simulation, ensured IEC 61850 GOOSE–MQTT interoperability, and implemented an AI-assisted Automatic Under-Frequency Load Shedding optimisation framework combining Gradient Boosting and binary integer linear programming.

The following contributions were delivered in support of public policy and regulatory development: (a) assessment of the economic externalities of wind energy and their system-level impacts (published in Renewable and Sustainable Energy Reviews); (b) active participation in code-of-conduct initiatives promoting interoperability standards between energy management systems and equipment manufacturers; (c) comparative analysis of selected European regulatory frameworks for self-consumption (published in Heliyon); (d) characterisation of the impact of energy communities on distribution network losses and development of dedicated loss factors to support regulatory implementation.

Active engagement in international associations further strengthened policy and strategic influence, resulting in: (a) selection of a key expert to contribute to DG CNECT studies on critical digital technologies; (b) contributions to the EERA Joint Programme on Digitalisation position paper for the European Commission on AI in energy systems; (c) membership of the core group drafting the ETIP SNET strategic paper on AI and Generative AI in smart grids for the European Commission; (d) contributions to the Adra

Strategic Research, Innovation and Deployment Agenda (SRIDA), including chairing the Energy Topic Group and participating in the European Commission Workshop on AI and Robotics; (e) leadership roles in multiple international working groups and task forces within CIGRE, IEA, ETIP SNET, and IEEE.

Activity Overview

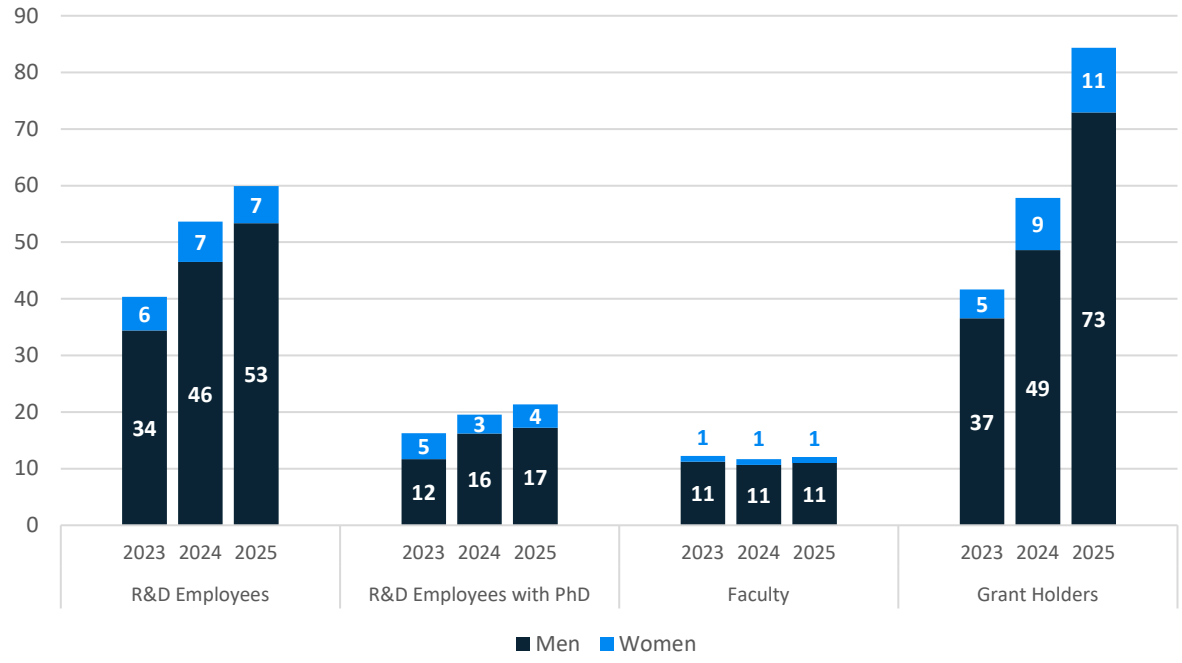


Figure 8.13 - CPES - Research team evolution (Person-years)

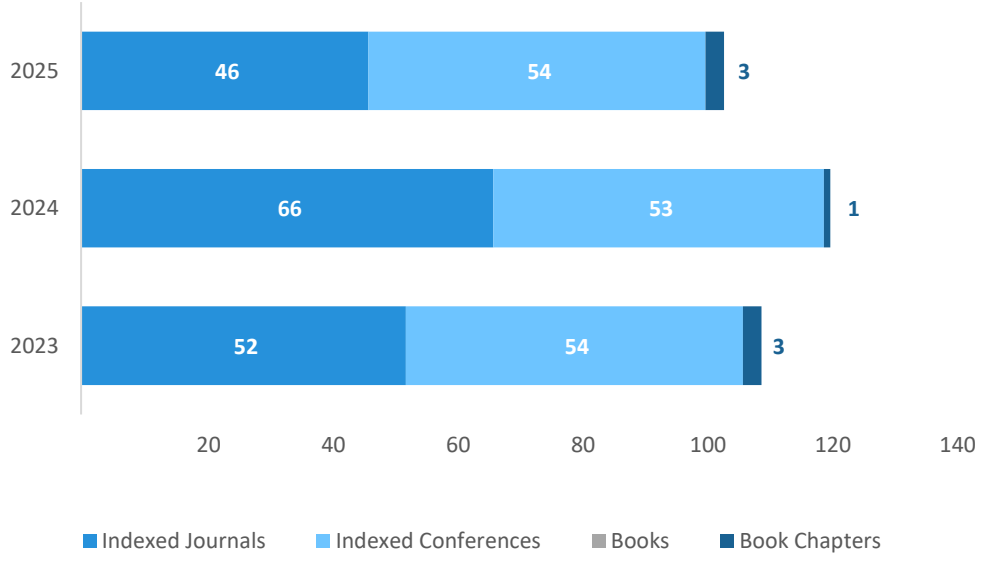


Figure 8.14 - CPES - Evolution of publications by members of the Centre (consolidated data)

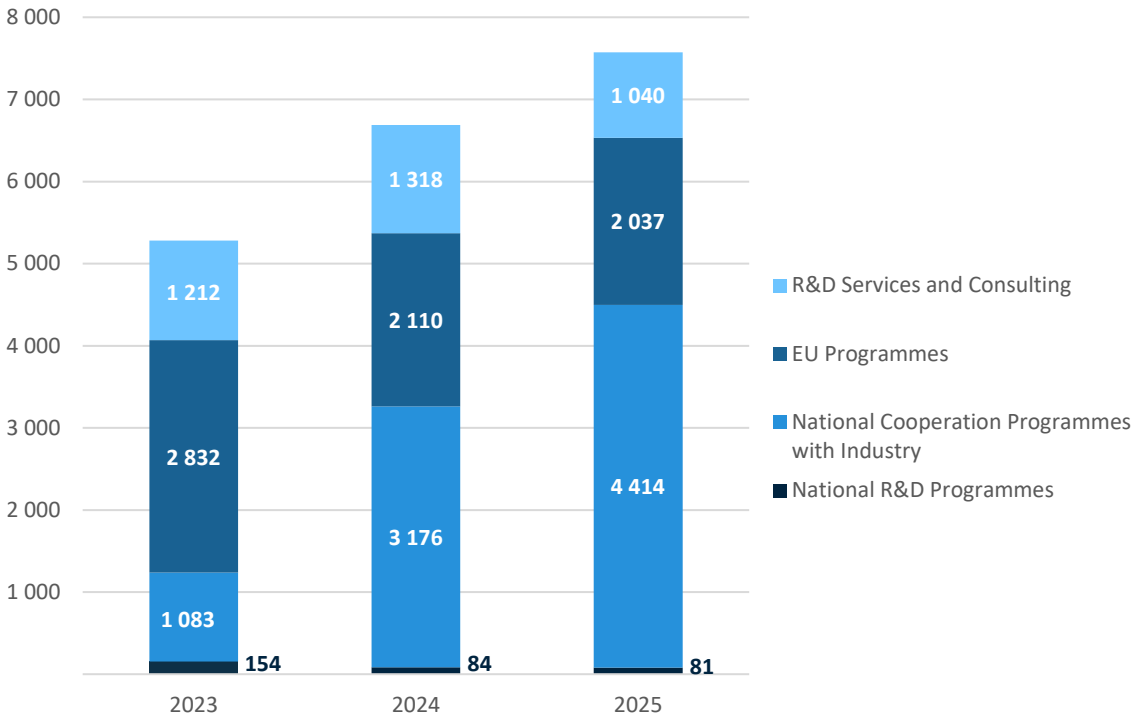


Figure 8.15 - CPES - Project funding evolution (k€)

8.6 CESE - CENTRE FOR ENTERPRISE SYSTEMS ENGINEERING

Coordinators: António Lucas Soares and Rui Rebelo

Presentation

CESE is a multidisciplinary research centre contributing to a sustainable, resilient, and human-centred industry through systems engineering. It plays the roles of both research and business partners in creatively co-developing solutions for complex challenges and developing industrial organisations' capabilities for an ongoing digital and green transformation. CESE's core scientific domain is Systems Engineering and Management, addressing five specific research lines: Manufacturing Design and Management, Supply Chain and Collaborative Networks Management, Industrial Information Systems, Technology Management in Industry and Transportation and Logistics.

Research outcomes in 2025

Manufacturing Systems Design and Management. During this period, our research was centred on integrating hybrid optimisation, simulation, and machine learning methods within Digital Twin architectures to enable adaptive design and dynamic reconfiguration of manufacturing systems, particularly in high-mix, low-volume environments. Consistent with Industry 5.0 principles, the programme further investigated human-centric manufacturing, developing inclusive AI-based interaction models to strengthen human–machine collaboration, support operator decision-making, and balance performance objectives with worker well-being and environmental sustainability. In the domain of eco-efficiency and sustainability, an eco-efficient planning algorithm based on multi-objective optimisation together with a simulation technique that evaluates the outcomes of planning algorithms, providing detailed insights into stoppages, emissions, and the impact of renewable energy sources will be used in more advanced consultancy services in this area.

Supply Chain and Collaborative Networks Management. In 2025, this research line continued to study innovative supply chain models and strategies to address complexity and uncertainty. Activities focused on developing and testing circular supply chain design and management strategies, particularly addressing remanufacturing processes and the role of digital technologies as enablers of circularity. The Supply Chain Resilience Fit Model was further applied to textile and agri-food ecosystems within the RISE SME project, including the organisation of workshops with companies. The European project ReSChape concluded, with INESC TEC coordinating the work package on policy recommendations and leading a cross-country European analysis of supply chain-related policies and regulations. Research on social sustainability and the socio-technical integration of AI in supply chain management also progressed. The team organised the EurOMA Sustainable Operations and Supply Chains Forum.

Industrial Information Systems. Research on the design of industrial digital platforms resulted in a validated set of socio-technical design propositions for a digital platform architecture to manage digital twin instances. These results are operationalised through an iterative socio-technical design process spanning strategy, social, ecosystem, organisational, technical, system analysis, and implementation. Research across several projects aimed at developing design knowledge for AI-based systems for industrial applications. A multi-agent architecture applicable to manufacturing was designed and prototyped, including agents that interact with an AAS, significantly improving the quality of model responses and their anchoring to assets and the company's context. A method for reusing ML models in industrial domains that enables more frugal MLOps has been developed and published, leading to a European project proposal currently in preparation.

Technology Management in Industry In 2025, the Technology Management in Industry research line achieved its objectives by advancing both theoretical and empirical knowledge related to technology adoption and human-centred digital transformation. Several journal publications contributed to a better understanding of the key predictors and behavioural mechanisms influencing collaborative robot adoption in manufacturing, as well as user acceptance in human–robot interaction. Ongoing research examined the impact of Industry 4.0 technologies on the triple bottom line, focusing on the barriers, enablers, and sustainability outcomes associated with digital transformation. Conference publications reported findings on Robotic Process Automation and Human-Centred Augmented Reality, further exploring the

organisational and human implications of emerging technologies. These studies aimed to characterise the roles of these technologies in enhancing supply chain resilience and operational performance. Additionally, research across several projects continued to develop frameworks and guidelines that support traceability, digital product passports, circularity, and sustainability maturity, particularly in the footwear industry. This work directly addressed business models, scalability strategies, and adoption challenges.

Logistics and Mobility. In Mobility as a Service (MaaS), a validated framework was developed to support the design of demand-responsive transport systems in low-density areas. Research also addressed collaborative methodologies for the co-design of sustainable urban mobility policy roadmaps. For urban logistics, innovative solutions on cooperative last-mile distribution were developed, notably within a newly funded FCT project. In intermodal freight operations and global supply chains, activities aligned with the NEXUS PRR agenda. A comprehensive state-of-practice review on digital twins for sustainable seaports was produced. Methodological developments focused on simulation and optimisation of just-in-time port operations (particularly tugboat scheduling), congestion mitigation in container terminals, and efficient hinterland container distribution. Initial integration of AI components yielded promising results. These activities resulted in three European project proposals, four peer-reviewed journal publications, and multiple conference contributions.

The research outcomes of CESE in 2025 contributed to the Systems Engineering and Management and Artificial Intelligence areas.

Innovation outcomes in 2025

In 2025, INESC TEC's innovation results consistently aligned with the objectives outlined in the Activity Plan, directly impacting the digital and sustainable transformation of the industry. Within the IKEA project, we designed and validated a proof-of-concept for production scheduling at the Pigment factory, supported by advanced tools. The roadmap for data management and governance for the Amorim Group provided a structured diagnosis of the current operational technology (OT) data architecture and governance model. This project identified critical gaps in integration, data quality, monitoring, and accountability. It also specified a modern TO-BE architecture based on open standards, combined with a federated data governance model, and outlined a realistic, phased roadmap to translate this vision into structured projects and implementation milestones. Overall, the project established the technical, organisational, and governance foundations necessary for managing OT data, improving interoperability between OT and information technology (IT), and enabling scalable, secure, and quality-driven industrial data management across the group. Concurrently, the outcomes of the PRR and CTI projects bolstered our portfolio in artificial intelligence (AI), interoperability, and eco-efficiency, advancing solutions toward Technology Readiness Level (TRL) 8. For the Digital Twin Low-Code platform, we consolidated our efforts, culminating in a patent filing for the automatic creation of simulation models. In our work on Automated Mobile Robots (AMR) and Automated Guided Vehicles (AGV) fleet sizing, in collaboration with CRIIS, we delivered advanced consultancy services, including work for IKEA, and tested camera-based inputs to anticipate and avoid obstacles within PRODUTECH R3. Finally, the Technology Adoption & Management team achieved significant outcomes in 2025 by integrating circularity, resilience, and digital transformation at both the EU and national levels. Notably, as part of the SoTecIn Factory project, we successfully coordinated a Circular Economy Fair, where 30 European startups presented ready-to-market technological solutions for the textile, plastics, packaging, and food value chains.

In this period, the centre's human resources composition remained the same as the previous year, except for the Grant Holders and Trainees category, which increased by almost 100%. This was mostly due to a more effective strategy for attracting master's students to develop their dissertations at the centre.

Activity Overview

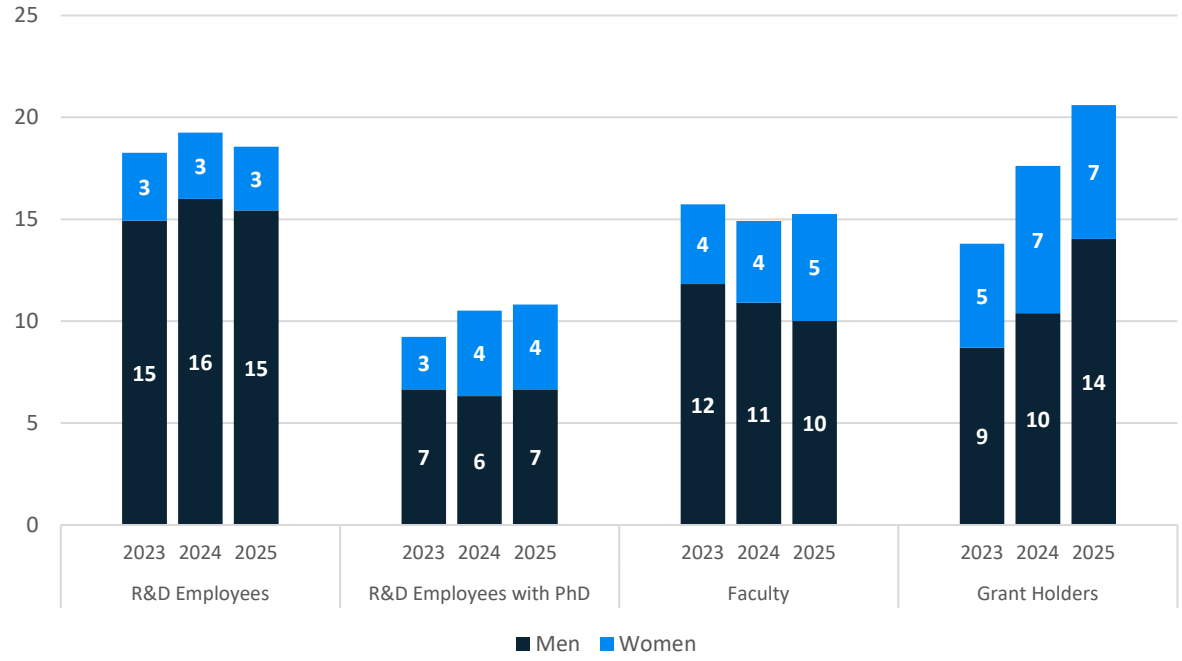


Figure 8.16 - CESE - Research team evolution (Person-years)

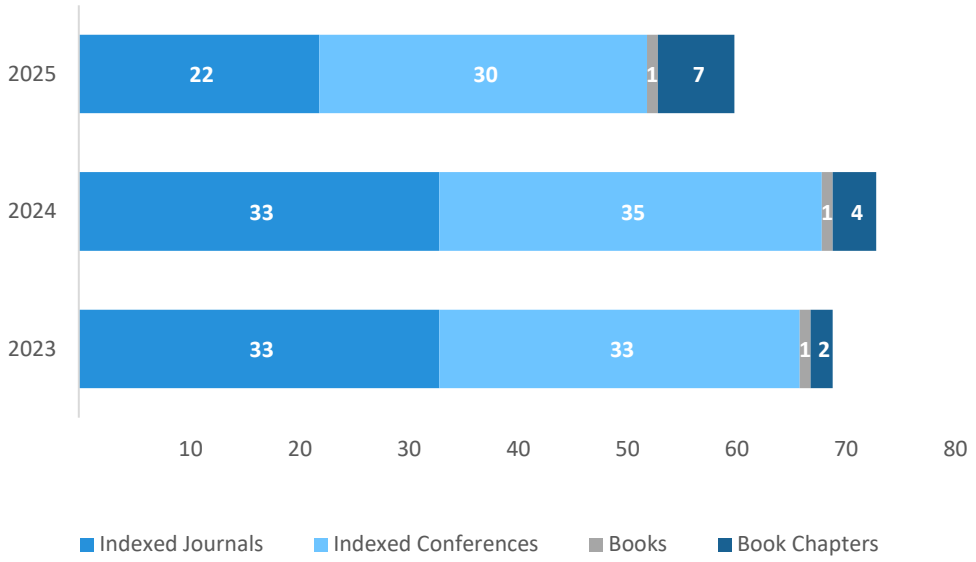


Figure 8.17 - CESE - Evolution of publications by members of the Centre (consolidated data)

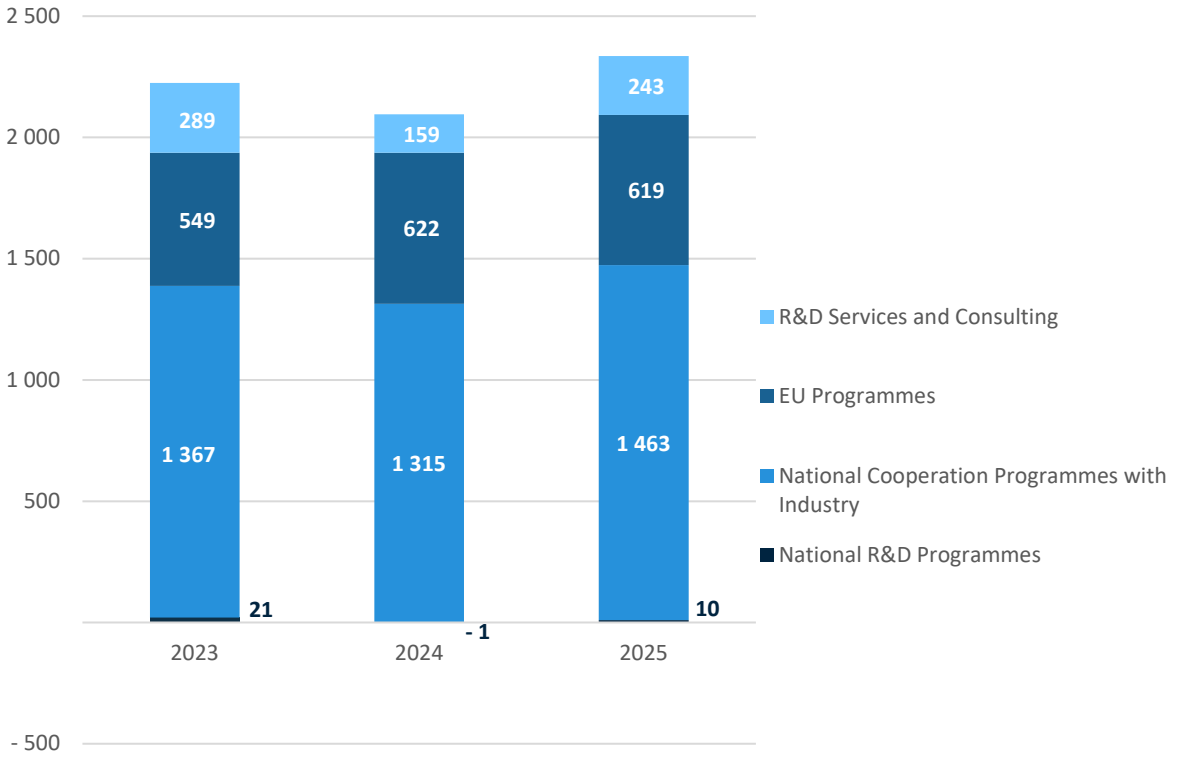


Figure 8.18 - CESE - Project funding evolution (k€)

8.7 CRIIS - CENTRE FOR ROBOTICS IN INDUSTRY AND INTELLIGENT SYSTEMS

Coordinators: Luís Freitas Rocha and Manuel Santos Silva

Presentation

The Robotics in Industry and Intelligent Systems Centre (CRIIS) designs and implements innovative robotics and intelligent solutions for industry, agriculture, and forestry, taking concepts from fundamental research through design, prototyping, and real-world deployment. In close collaboration with academia and industry, CRIIS develops cutting-edge robotic designs, powered by AI and computer vision, human-robot interaction tools, and advanced end-effectors and tooling concepts. The centre also focuses on developing new IoT and cyber-physical devices for data acquisition and monitoring across diverse environments.

Research outcomes in 2025

Enhancing Robot Autonomy and Manipulation Capabilities: In this research line, the centre focused on advancing robots' autonomy and manipulation capabilities in complex environments by integrating Robotics and AI domains. Key advancements were made in autonomous mobile robots (AMRs) specifically to optimise key processes such as localisation, control, fleet coordination, and task allocation. One of the key topics was precise 3D localisation in complex industrial environments [1]. The resulting breakthroughs enhanced mapping and navigation using 3D LiDAR technology. The team also annotated an extensive dataset combining real-world and synthetic data and conducted an in-depth analysis of various SotA algorithms to pinpoint areas for further improvement. Concerning industrial manipulators and the generalisation of manipulation capabilities, CRIIS developed a novel, user-friendly framework that automatically generates large-scale, accurately labelled bin-picking datasets directly from CAD models [2]. It combines photorealistic rendering with physics simulation to reduce the “synthetic-to-real” gap. Additionally, with the ibot4CRMs project, a computer vision method incorporating Deep Learning for screw detection, classification, and robotic tool selection was developed to enable automatic disassembly and recovery of Critical Raw Materials (CRMs) from End-of-Life (EOL) products.

Design sustainable, trustworthy robotic systems and IoT solutions: This research initiative made significant contributions across multiple domains. (1) Research on the Modular-E platform, in the PHENOBOT project, advanced robotic phenotyping in agriculture. The platform now features an articulated robotic arm tool for high-precision phenotyping in real vineyard conditions, with a sensing module and a lightweight manipulator that positions cameras and multispectral sensors directly within the canopy. Field trials demonstrated significant improvements in trait measurement accuracy, enabling detailed assessment of canopy structure, growth, and plant health indicators [3,4]. (2) In the forestry sector, and within the AgendaTransform project, a new prototype, ASSeT, was built upon the Modular-X platform to automate stem selection in young eucalyptus stands. ASSeT integrates a cost-effective robotic manipulator equipped with a precision cutting tool that autonomously identifies, selects, and removes small competing stems around the main stem. (3) In parallel, CRIIS advanced real-time plant metabolic measurement technology with a wearable system that monitors plant metabolism, thermodynamics, and mass flows. This data is fed into multi-scale digital twins, including systems biology models and multiphysics simulations, leading to a new patent proposal. (4) In the manufacturing domain, and within the Hi-rev project, CRIIS developed an explainable AI-driven automated visual inspection system for reflective industrial parts. This solution integrates robotic handling, dome lighting, and high-resolution imaging to inspect parts precisely. To optimise computational efficiency, a class-activation-mapping-guided tile-inference strategy was introduced, limiting detection to relevant regions identified by EigenCAM, a gradient-free explainability method.

XR-based Human-Robot Interaction: In the area of HRI, CRIIS made advancements in teaching robots complex manipulation tasks and optimising task scheduling for human-robot teams. A key achievement was the development of an XR-based teaching framework, which enabled human operators to demonstrate manipulation tasks to robots using Extended Reality (XR) headsets. These demonstrations, captured in real time, provided the data needed to train robots using behaviour cloning algorithms, enabling them to replicate human actions. CRIIS also introduced a task-scheduling algorithm that optimised task

allocation within collaborative human-robot teams, ensuring efficient resource utilisation. The system dynamically assigned tasks based on agent capabilities, task complexity, and operational constraints.

Generative AI-Enhanced Digital Twins for Industrial Robotics: In this research line, the Centre advanced the integration of GenAI, Large Language Models (LLMs), and Vision-Language Models (VLMs) into Digital Twin infrastructures for industrial robotics. The novel framework ensures continuous synchronisation between physical robotic systems and their digital counterparts through Retrieval-Augmented Generation (RAG) and Model Context Protocol (MCP)-based data orchestration. This framework enables recognition, localisation, and continuous virtual representation of objects within complex facilities, ensuring that Digital Twins remain accurate as real-world conditions change. A patent application was submitted.

Innovation outcomes in 2025

Mobile Manipulator for Container Unloading: CRIIS has enhanced its mobile manipulator solution, which received the Technology Transfer Award from the Portuguese Robotics Society in 2025, with cutting-edge hardware upgrades (new gripper design) and software improvements to perception and path planning. These innovations enabled the automation of trailer unloading at TRL 7. The development of RicoSlam, a dynamic SLAM system, enables real-time autonomous navigation within confined shipping containers.

Advanced Docking & Pallet Detection: The centre introduced a new, highly accurate pallet detection system integrated with a docking solution. Using AI, the system determines the 6 Degrees of Freedom (DoF) position of pallet pocket centres via a low-fidelity RGB-D camera, with detection ranges up to 4 meters and 45 degrees. This solution, now at TRL 8, significantly improves pallet handling accuracy. A patent application was submitted to protect the innovative findings.

AI-Driven Robotics for Textile Recycling: CRIIS made a significant contribution to the textile recycling domain with an advanced fibre classification system that combines near-infrared hyperspectral sensing and Convolutional Neural Networks (CNN) to classify fibre composition. Initially tested at the laboratory level, it was later deployed at Lipor's recycling centre. Additionally, a robotic prototype capable of handling stretched garments was also developed. Through AI-powered computer vision, the system identifies and estimates the locations of visible and occluded accessories, automating their removal.

Cloud-Native Robotics and Software Lifecycle for Industrial AI Systems: CRIIS solidified its cloud-native robotics strategy with CI/CD pipelines for robotics applications, cloud-based simulations, and Kubernetes-based orchestration, ensuring scalable and reliable integration of AI into industrial robotics.

Modular-E and Modular-X Platforms for Real-World Deployment in Agriculture and Dual-Use Scenarios: Regarding dual use, the centre delivered primary innovation outcomes through the evolution of the Modular platforms (TRL 7-8). Modular-E received multiple international distinctions, including the Silver Medal for Best World FIRA Robot 2025, and was a finalist for the Innovation Vanguard Awards (IVA), which recognise leading global achievements. Meanwhile, Modular-X was showcased in dual-use demonstrations at ARTEX 2025, and CRIIS initiated a cooperation program with CEMTEx to adapt its capabilities for logistics and CASEVAC missions with the Portuguese army.

Field Demonstrations and Public Showcases Strengthening Technology Transfer: The centre organised and participated in several high-visibility events, fostering direct industry interaction. These included Synergy Day 2025 (with UTAD, ADVID, and Sogrape), PHENOBOT vineyard trials, and WATSON project pilot deployments at Quinta do Seixo, which were featured on Euronews. The centre led 5G pilot demonstrations within the NOS TestBed Initiative. It showcased at events such as ERF, ADRA (including a keynote on Urban Mining and AI-powered Robotics), FIRA and ARTEX 2025, the "Forum Digital" hosted by The Navigator Company, and the "Sensibilização Ambiental sobre Separação de Resíduos" by EGF. CRIIS also participated in "Como se cose a circularidade dos têxteis?" (LIPOR/BE@T project) and the European Commission event "Beyond waste: shaping the future with bio-based materials," spotlighting the Waste2Biocomp project.

Enhanced supervision and Teleoperation of Robot Fleets: In 2025, CRIIS developed an innovative modular teleoperation system, conducted through a virtual reality (VR) environment, specifically designed for mobile robot fleets. This system enables remote control and supervision of multiple mobile robots via

5G connectivity and video capture, allowing operators to manage diverse robotic platforms across complex industrial environments.

[1] J.D. Ribeiro, R.B. Sousa, J.G. Martins, A.S. Aguiar, F.N. Santos, H.M. Sobreira (2025). "Indoor Benchmark of 3-D LiDAR SLAM at Iilab-Industry and Innovation Laboratory," in IEEE Access, vol. 13, pp. 212421-212442, doi: 10.1109/ACCESS.2025.3643753.

[2] A. Cordeiro, L.F. Rocha, J. Boaventura-Cunha, E.J. Solteiro Pires, J.P. Souza (2025). Object segmentation dataset generation framework for robotic bin-picking: Multi-metric analysis between results trained with real and synthetic data, Computers & Industrial Engineering, Vol. 205, 111139, doi: 10.1016/j.cie.2025.111139.

[3] R. Tosin, L. Rodrigues, M. Santos-Campos, I. Gonçalves, C. Barbosa, F. Santos, ... & M. Cunha (2025). Metabolic maps from hyperspectral data for precision grape maturation and decision-making. In Precision agriculture'25 (pp. 198-205). Wageningen Academic.

[4] R. Martins, F. Santos, M. Campos, A. Silva, R. Tosin, S. Magalhães, M. Pereira (2025), Method and device for non-invasive tomographic characterisation of a sample comprising a plurality of differentiated tissues, U.S. Patent Application No. 18/724,833.

Activity Overview

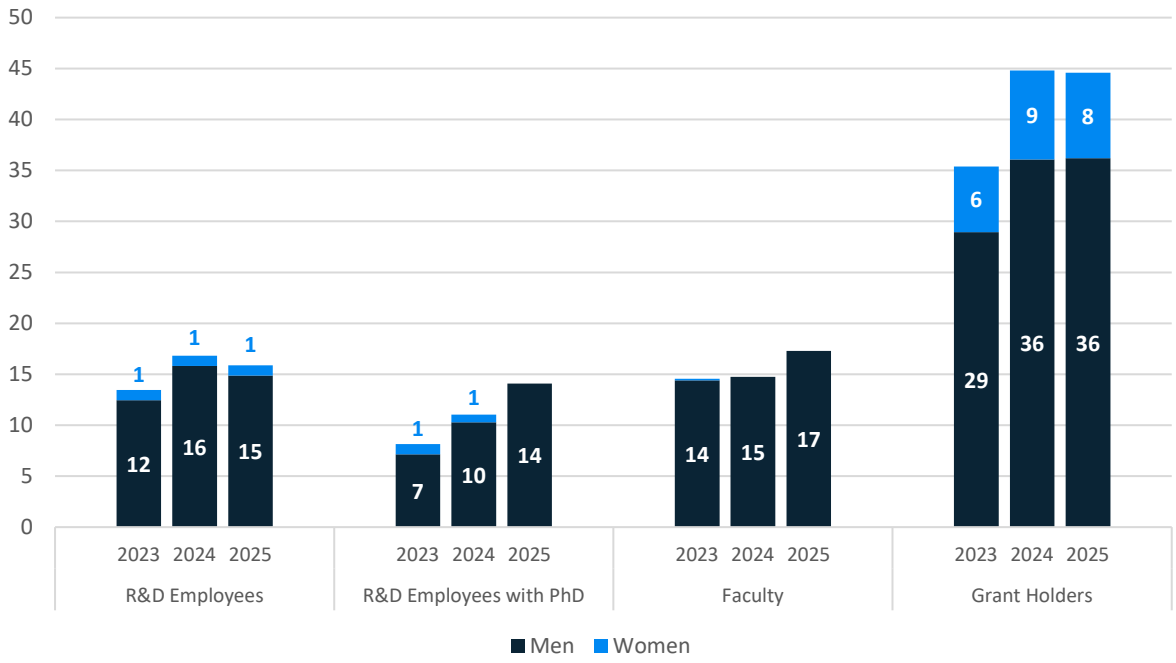


Figure 8.19 - CRIIS - Research team evolution (Person-years)

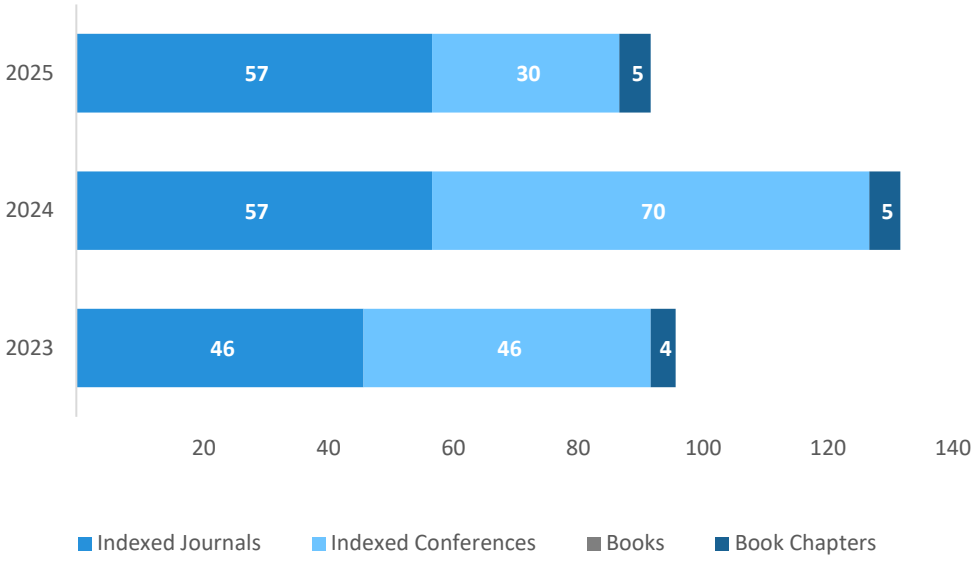


Figure 8.20 - CRIIS - Evolution of publications by members of the Centre (consolidated data)

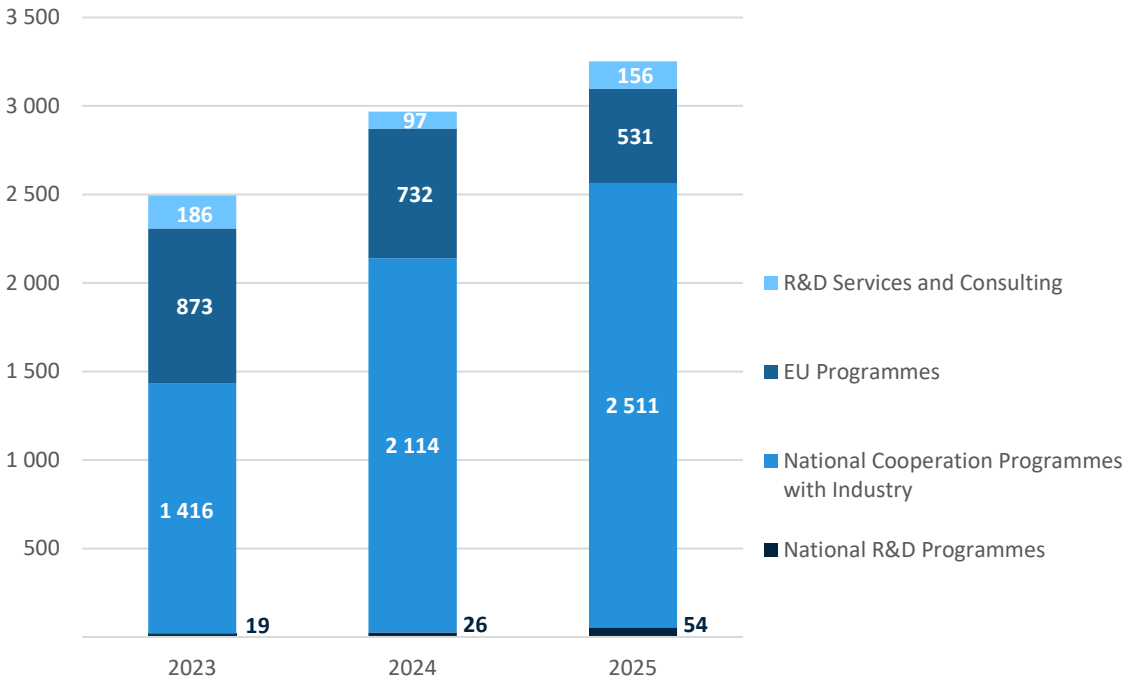


Figure 8.21 - CRIIS - Project funding evolution (k€)

8.8 CEGI - CENTRE FOR INDUSTRIAL ENGINEERING AND MANAGEMENT

Coordinators: Maria Antónia Carravilla and António Almeida

Presentation

Operating at the intersection of industrial engineering, management science, and advanced analytics, CEGI develops robust decision-support systems to address dynamic, uncertain, and complex socio-technical challenges. The Centre integrates competences across Operations Research and Operations Management, Business Analytics, Performance Evaluation, Service Science, and Public Policies. These competences are applied to strategic sectors including manufacturing, logistics and mobility, energy transition, retail and agro-food, healthcare, media, and climate resilience. Throughout the year, activities remained aligned with INESC TEC's strategic priorities, strengthening scientific excellence, reinforcing innovation ecosystems, and increasing visible societal impact. 2025 was characterised by consolidation of core optimisation and AI capabilities, expansion into quantum-enabled optimisation, strong participation in European projects, visible industrial demonstrators, and recognised impact at national and European levels.

Research outcomes in 2025

In 2025, CEGI significantly strengthened its scientific contribution to Systems Engineering and Management through high-impact research in optimisation under uncertainty, AI-enabled decision systems, sustainability analytics, and integrated mobility operations.

A central research line focused on dynamic and stochastic decision-making in complex operational environments. Advances were achieved in adaptive dispatching rule selection for dynamic job shop scheduling, delivering measurable improvements over state-of-the-art rules. In routing and supply chains, new robust optimisation models were developed for synchronised vehicle routing under travel-time uncertainty, while comprehensive reviews structured the fields of dynamic inventory-routing and online retail order allocation and returns re-routing. CEGI consolidated international leadership in integrated routing, packing, and loading optimisation. A new integrated three-dimensional loading and vehicle routing model for first-mile pickup operations was formulated, incorporating split pickups, time-dependent travel, stability, and reachability constraints. In parallel, a novel GRASP-based multi-objective optimisation framework for cooperative operational planning in tuna purse seine fisheries was developed, explicitly modelling trade-offs between economic performance and operational criteria across fleets. Additional contributions addressed online 3D packing with realistic stability modelling, benchmarking of pallet stability approaches, mosaic generation for AMR-based automated truck loading, and algorithmic planning for sequential 3D printing, bridging advanced optimisation with practical execution constraints.

FCT projects led by CEGI researchers were particularly relevant in 2025**. BeFresh** advanced optimisation and pricing models for perishable products, supporting food waste reduction and sustainable retail operations. EDUBEST applied performance evaluation and efficiency analysis models to the education sector, strengthening evidence-based policy and institutional decision-making. Within the **CIBELE** project, multi-objective optimisation models were developed integrating waste minimisation and pattern complexity in two-dimensional cutting problems, enabling explicit trade-off analysis between material efficiency and operational simplicity and reinforcing sustainability-driven industrial optimisation. In addition, the new FCT project **AIO-TacitRouting** was approved, further consolidating research at the intersection of AI and optimisation for last-mile routing.

In the energy and resilience domains, research progressed through **EUSCORES** (energy asset optimisation), **DECODIT** (citizen engagement for digital technology adoption), and FIRE-RES (wildfire resilience modelling). The successful conclusion of **Trust-AI** reinforced leadership in the development of explainable and trustworthy AI systems.

Sustainability-oriented research was reinforced through quantitative analyses of municipal solid waste policy alignment, integrated environmental and nutritional sustainability assessment of dietary patterns, and empirical modelling of energy poverty engagement behaviours across European cities. Climate-

adaptive inventory management models for multi-age products (port wine) underprice uncertainty delivered interpretable decision rules that significantly improved over benchmark policies.

Mobility systems research advanced behaviourally informed optimisation by embedding discrete choice models directly into pricing and relocation decisions in free-floating carsharing. Complementary work developed profit-optimised churn prediction and efficiency benchmarking frameworks for taxi operations, integrating machine learning, optimisation, and interpretability to support sustainable urban mobility. A forward-looking milestone was the approval of a multi-centre FCT Exploratory Project on quantum-enabled optimisation, leveraging complementary expertise across INESC TEC. In parallel, the submission of the ERC Synergy Grant Q-Motion positioned CEGI at the frontier of hybrid quantum-classical computational science for human-centric mobility ecosystems.

Innovation outcomes in 2025

In 2025, CEGI reinforced its ability to translate scientific advances into deployable industrial tools, structured organisational methods, and policy-relevant outputs. Within Produtech R3, in collaboration with The Navigator Company, Luís Simões and WFScork, advanced optimisation algorithms for container loading and pallet mosaic generation were integrated into a logistics demonstrator, becoming the first CEGI-developed demonstrator included in the Industry and Innovation Lab (iiLab). Participation in the Transport Logistic Fair in Munich strengthened international visibility.

Several industry-validated decision-support applications were delivered. An Optimised Loading Mosaic Generator for double-deck semi-trailers was developed with Burgers Group from Netherlands, automatically generating compliant loading plans that maximise volumetric and weight capacity while enforcing axle-load regulations. A Mosaic Generation Tool for pallet loading under dimensional uncertainty was implemented with a Dutch distributor, producing robust configurations that remain feasible despite variability in box dimensions. Advanced industrial nesting solutions for highly defective ornamental stone slabs, explicitly incorporating overcut and lifter positioning constraints into the optimisation process, thereby generating machine-compatible layouts and significantly enhancing feasibility, operational robustness, and material efficiency. Complementarily, an optimisation-based decision-support tool was developed in which different cutting-complexity measures are explicitly embedded in the mathematical model.

Within organisational innovation, the team formalised a transferable AI ideation methodology, supported by a GenAI companion tool, enabling organisations to develop balanced AI roadmaps that position generative and analytical AI as complementary approaches. Policy-oriented impact was achieved through FIRE-RES Portuguese Living Labs, resulting in a policy brief applying the Mental Models Approach to improve wildfire risk communication strategies and align expert and community perspectives. Innovation engagement extended to PRR agendas such as Smartgnosis (AI-based bacteria detection with ALS), AgendaTransform (advanced analytics for energy asset transformation with REN), InsectERA (modelling for sustainable bio-based production), and SYSTEMEU (with CCDRN), promoting multi-regional ecosystem collaboration.

Through contract research with Tlantic and Grupo Impresa, CEGI applied artificial intelligence, reinforcement learning and advanced data analytics to dynamic workforce scheduling and churn mitigation problems, strengthening internal competences in secure large-scale data infrastructures, including S3 storage platforms, Apache Spark and parquet-based architectures.

External recognition reinforced impact visibility. The FCT TacitRouting project received the PEL Academia 2025 Prize from APLOG, and KEPsoft was recognised as a winner of the EARTO Awards in the “Expected Impact” category.

Activity Overview

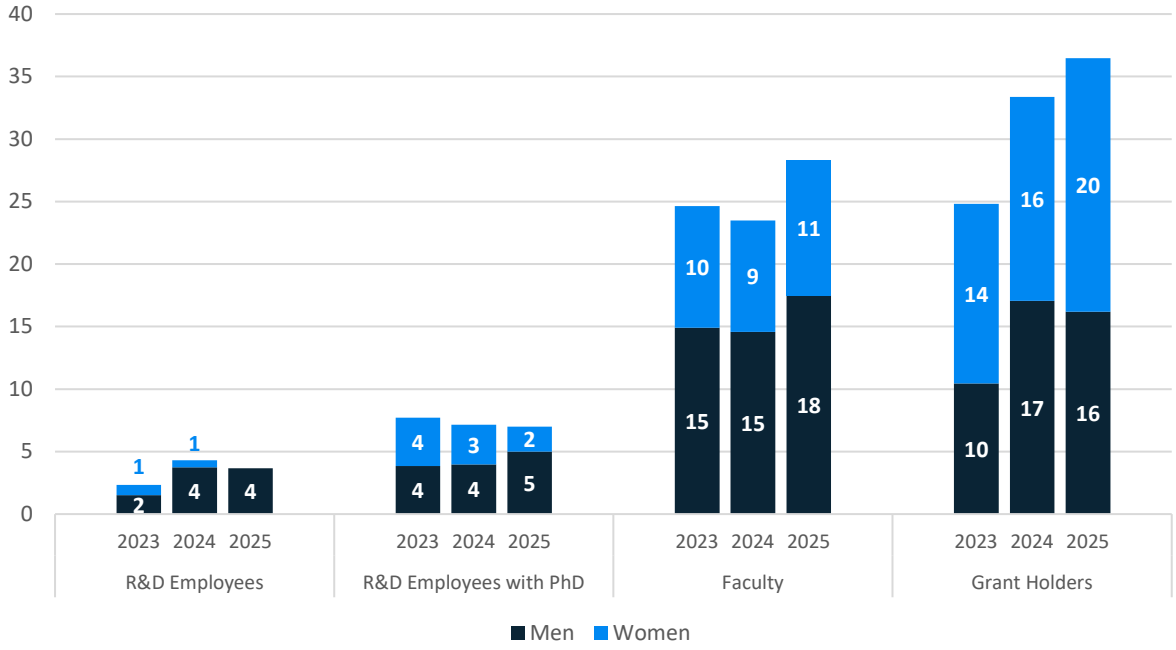


Figure 8.22 - CEGI - Research team evolution (Person-years)

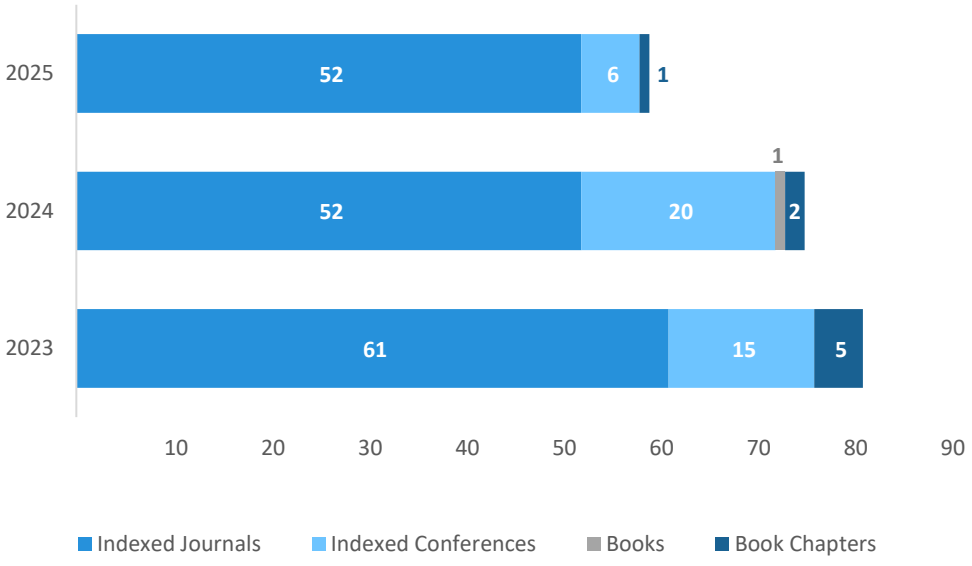


Figure 8.23 - CEGI - Evolution of publications by members of the Centre (consolidated data)

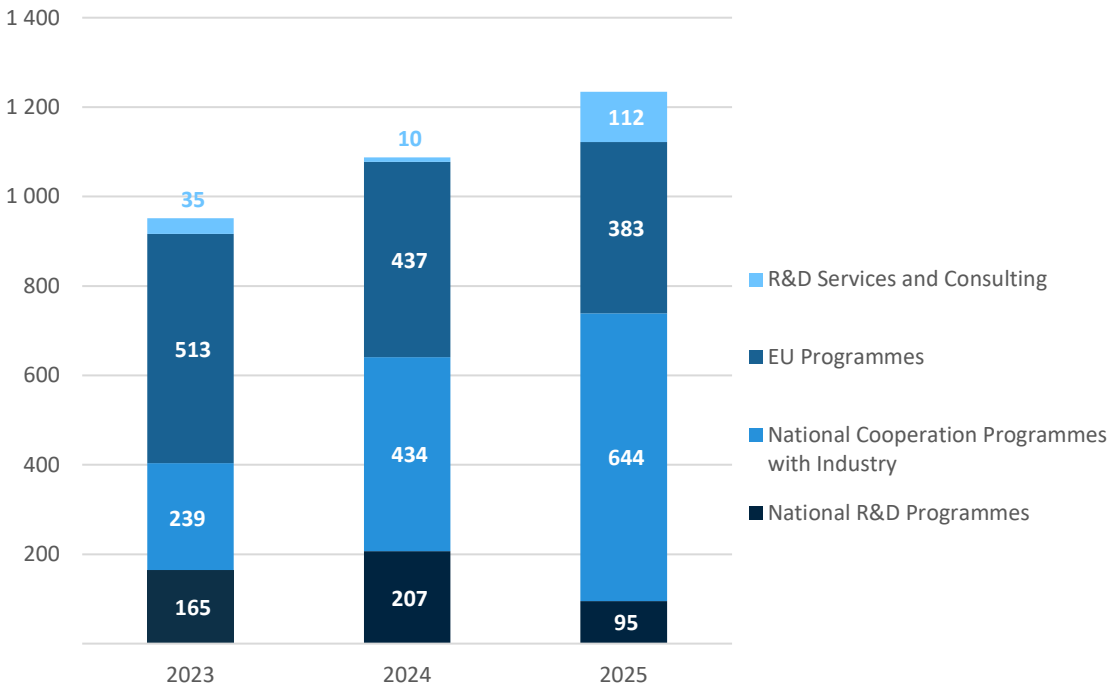


Figure 8.24 - CEGI - Project funding evolution (k€)

8.9 CITE - CENTRE FOR INNOVATION, TECHNOLOGY AND ENTREPRENEURSHIP

Coordinator: Alexandra Xavier

Presentation

CITE empowers researchers and organisations by advancing the adoption of socio-technical innovation systems, cultivating a dynamic culture of innovation, and fostering entrepreneurial excellence. Through multidisciplinary research at the intersection of technology, innovation, sustainability, and management, aims to promote the adoption and use of responsible, human-centred innovations in engineering. By focusing on the research areas of Innovation Management and Front End of Innovation (RL1), Technology Management and Policy (RL2), and Entrepreneurship & Business Model Innovation (RL3), CITE explores theories, methods, models, and tools to support the innovation process. Through research and innovation activities, including advanced training and a strong collaboration with Entrepreneurship Support Initiatives, CITE addresses environmental, social, and economic challenges, contributing to research and innovation impacts aligned with the SGD goals.

In 2025, CITE participated in six European R&D projects (Fire Res, SoTecIn Factory, Mantra, EEN, Ai4REALNET, POEMS) and five PRR projects, strategically focused on: (i) Advancing methodologies and tools that strengthen the exploitation of research outcomes, maximising the societal and economic impact of European and National projects (FIRE-RES, AI4REALNET, Insectera, ATE); (ii) Research and innovate in the methods and tools that support the conceptualisation, implementation, and evaluation of high impact open innovation campaigns (FIRE-RES, Mantra; SoTecIn Factory); (iii) researching novel business models (NEXUS, ATE, FIRE-RES); and (iv) Provide a catalogue of training and consultancy services on Innovation and Technology Management, Technology Exploitation, Sustainability and Operations Management.

Research outcomes in 2025

In 2025, Cite achieved high scientific outcomes. Research emphasised theoretical advances and practical impact, focusing on sustainability, innovation assessment, entrepreneurship, and resilient communities. Key outputs include:

- Energy Transition Recommendations (RL1/RL2) – Study under ATE identifying drivers, barriers, and socio-technical factors influencing the adoption of innovative energy solutions.
- Innovation Strategies for Port of Sines (RL1) – NEXUS project survey analysing technology adoption interest and business potential of advanced mobile networks; presented in Deliverable 6.3.
- Technology Exploitation Strategy Methodology (RL2) – Framework guiding researchers to assess the value and exploitation routes of socio-technical solutions (FIRE-RES).
- Responsible Innovation Assessment Tool (RIAT) (RL1) – Structured framework enabling early and continuous evaluation of project sustainability and ethical performance.
- KPI Adoption Template (RL3) – Tested with 30 innovators to measure economic, environmental, and societal sustainability impacts; developed in the master's thesis "Sustainability Indicators for Mission-Oriented Innovation" (MIET).

Highlights of Publications:

- Guimarães, C.M., Amorim, V., Almeida, F. (2025). Responsible Research and Innovation (RRI) Assessment: The Path to a Tool. In: Zimmermann, R., Rodrigues, J.C., Simoes, A., Dalmarco, G. (eds) Human-Centred Technology Management for a Sustainable Future. IAMOT 2024. Springer Proceedings in Business and Economics. Springer, Cham. https://doi.org/10.1007/978-3-031-72490-9_51
- Kurteshi, R., & Almeida, F. (2025). Building and developing entrepreneurial team identity: insights from the CEU iLab incubation. International Journal of Entrepreneurial Behavior & Research, In Press.

- Almeida, F. (2025). Community Involvement and Entrepreneurial Outcomes in Sustainable Open Innovation. Environment, Innovation and Management, 1, 1-17.
- Almeida, F., & Deutsch, N. (2025). Urban Living Labs as Catalysts for Innovation: Advancing Urban Ecosystems within the Quintuple Helix Model. Urban Governance, 5(2), 133-141.

Innovation outcomes in 2025

As innovation results, Cite highlights:

- **IN.SPIRE Innovation Program:** The program consolidated research and practical tools for innovation management, including open innovation, co-creation, innovation campaigns, and sustainable design. The program generated 22 strategic contacts, with five organisations moving to structured needs analysis, strengthening collaboration and commercialisation opportunities.
- **Energy Transformers – Energy Transition Program:** The program supported ATE partners through co-creation workshops and a video bootcamp, accelerating the exploitation of products and processes. Participants gained tools for identifying value propositions, building partnerships, and developing dissemination strategies.
- **Sustainability Needs Assessment and Innovation Community Building:** Under the Mantra project, a sustainable needs assessment tool will be applied to identify the sustainable transition requirements of the textile, metal, and food industries. An open Call has been launched, and as a result, 124 manufacturing SMEs applied (5 from Portugal); 60 SMEs were selected in stage one. Additionally, 174 tech-savvy SMEs showed interest in project activities.
- **Under the HftP Project, a full training program for healthcare services has been developed:** Innovation & Technology Management consultancy, Sustainability in Healthcare training, Healthcare Operations Management, and waste reduction. All services will be available on a platform.
- **Entrepreneurship & Spin-off Office** launched in collaboration with SAL.

As part of the dissemination activities, CITE highlights:

- Conference Presentations – Responsible Innovation & Sustainability:
- IAMOT 25 Conference – Panel speaker; presented “Responsible research and innovation (RRI) assessment: monitoring innovation processes and ensuring sustainability projects’ results”.
- EurOMA Sustainable Operations and Supply Chains Forum 2025 – Speaker; presented “Circular impact strategies: new ventures' contributions to resilience in industrial value chains”.
- ISPGAYA 2025 – Speaker; presented “RIAT – Responsible Innovation Assessment Tools, towards sustainability”.
- Second Economy of Francesco Portugal Conference – Speaker; presented “A Responsible Innovation tool for business transitions”.
- Specialised Panels & Workshops:
- FIRE-RES International Event – Roundtable panellist for “A Boost for Financially Resilient Innovations in Wildfire Management”.
- XXVI World Congress of the International Union of Forest Research Organisations (IUFRO) – Speaker.
- AI, Data, Robotics Forum 2024 Workshop (Ai4REALNET project) – Organizer and speaker; presented “From Algorithms to Assurance: Designing Human-Centric AI for Collaboration, Trust, and Acceptance”.

Activity Overview

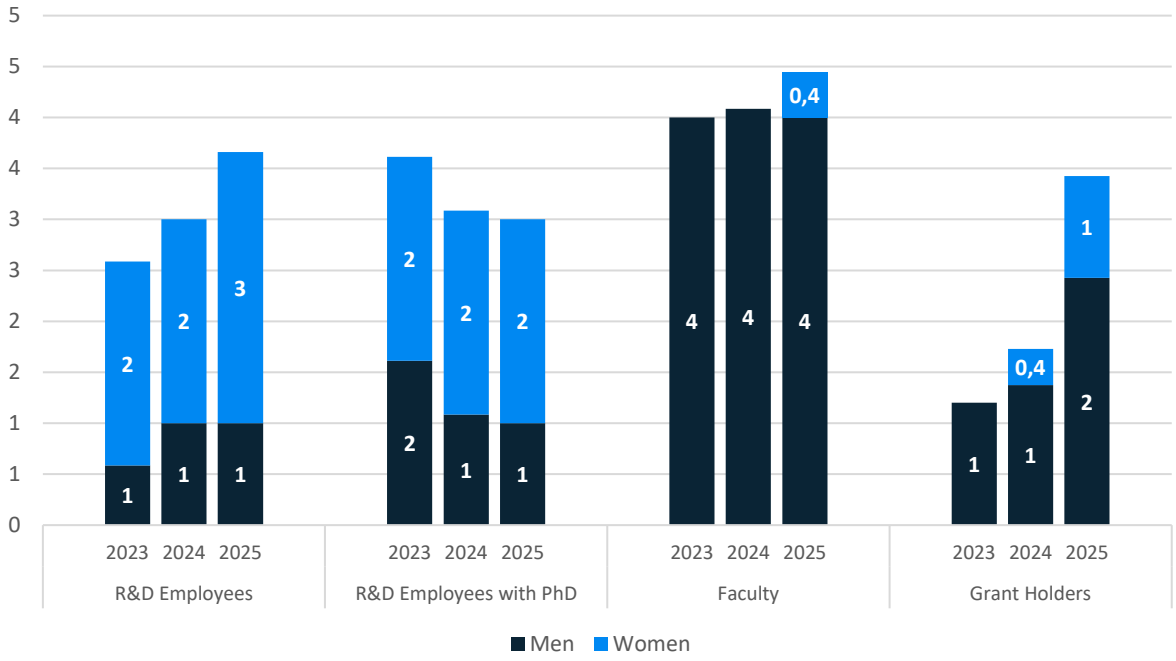


Figure 8.25 - CITE - Research team evolution (Person-years)

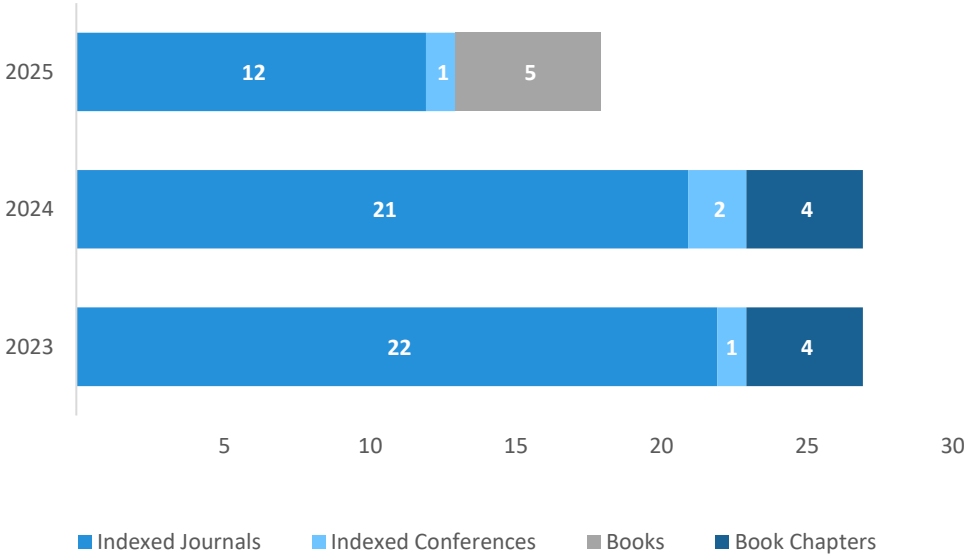


Figure 8.26 - CITE - Evolution of publications by members of the Centre (consolidated data)

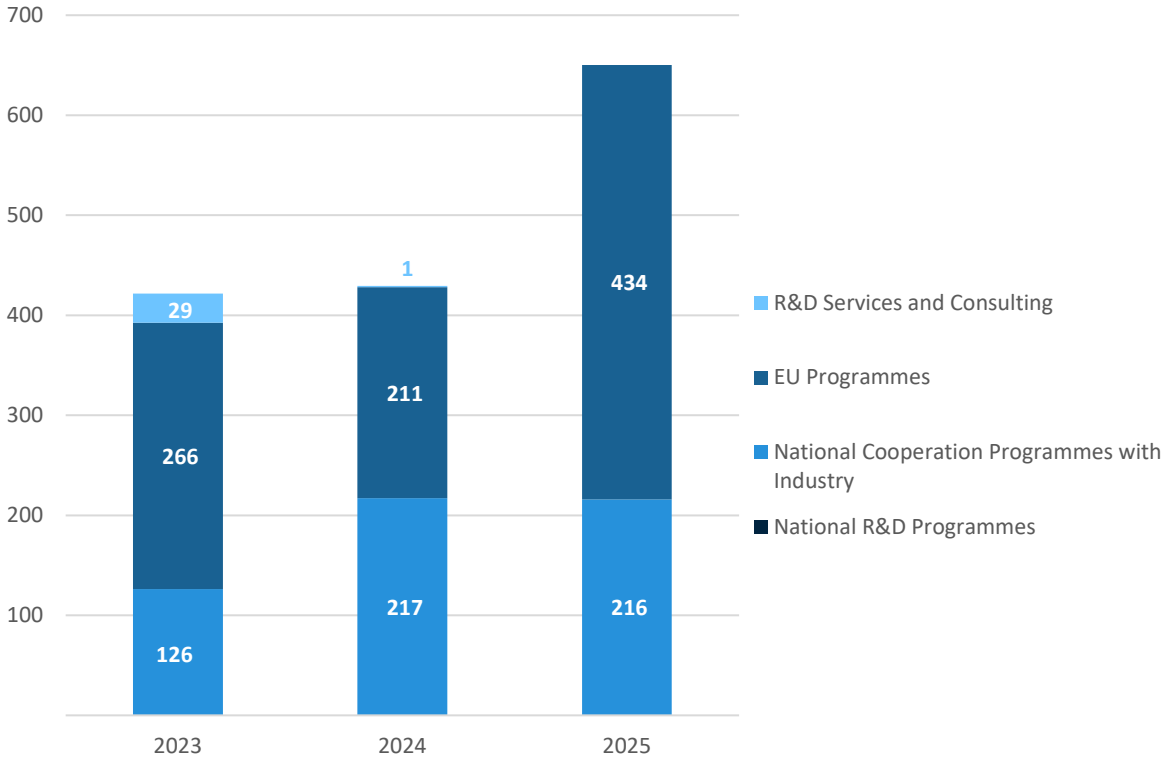


Figure 8.27 - CITE - Project funding evolution (k€)

8.10 HUMANISE - HUMAN-CENTRED COMPUTING AND INFORMATION SCIENCE

Coordinators: Ademar Aguiar, Artur Rocha and Hugo Paredes

Presentation

In 2025, the research centre continued to operate at the forefront of Human-Centred Computing, Computer Science, and Information Science, developing systems, methods, and tools across the full spectrum of complex software-intensive systems, including applications, enterprise platforms, digital twins, digital games, and embedded solutions. The overarching objective remained the augmentation of human capabilities within organisational and societal contexts.

Activities were structured around six research areas and four innovation domains, ensuring comprehensive coverage of the software systems stack while integrating state-of-the-art scientific and technological advances. The Centre maintained strong collaboration with academic and industrial partners, combining high-quality research with innovation, consultancy, and technology transfer.

During 2025, strategic measures were implemented to strengthen researcher attraction and retention, including infrastructure improvements and upgrades to computational resources. The Centre also reinforced its commitment to advanced training, with sustained supervision of MSc and PhD students within a research community spanning Universidade do Porto, Instituto Politécnico do Porto, Universidade de Trás-os-Montes e Alto Douro, and Universidade Aberta.

Research outcomes in 2025

Information Management and Information Systems (IMIS). In 2025, work continued across projects and collaborations in information systems, research data management, data infrastructures, information retrieval, and information visualisation and interaction. In health information systems, within the Health from Portugal PRR project, we contributed to the creation of a Portuguese (PT-PT) clinical notes dataset and to research on summarisation of clinical notes. In the RECONNECTED EU project, work focused on data infrastructures and human–information interaction in the context of mental health literacy and social participation. Dataset development was extended through collaboration with LUSA on news data and the creation of a pioneering dataset for Tetun (Timor-Leste), the first of its kind for the language. We maintained participation in the YouthDMH and GOBLIN COST Actions, contributed to the Diversity and Inclusion Working Group of Informatics Europe, and attended the 61st CIDOC CRM and 54th FRBR/LRMoo SIG Meeting as observers. In collaboration with LIAAD, we continued work on narrative exploration in the StorySense FCT project and contributed to the approved CitiLink (FCT/PRR) project through dataset development, information retrieval, web interface prototyping, and user studies for validation.

Computing for Embedded and Cyber-Physical Systems (C4E&CPS). In 2025, particular focus was given to participation in several international collaborations within the scope of the Chips JU, particularly on RISC-V processors in embedded systems and advanced computing platforms for cyber-physical systems. This led to the submission of several European projects and one doctoral network proposal. Researchers in the field led an EU proposal for open-source EDA tools, which was approved. The area also actively participated in working groups within the INSIDE association and in the steering and programme committees of conferences and workshops such as AEiC, ETFA, WFCS, ISORC, and DeCPS. As a transversal activity to several INESC TEC centres, the area was involved in the Portuguese competence centre on semiconductors and microelectronics (POEMS).

Human-Computer Interaction (HCI). In 2025, the HCI area sustained a broad and integrative research agenda encompassing Human-Centred and Explainable AI, social and collaborative computing, context-aware and ubiquitous systems, multimodal interaction, and responsible design. The area strengthened its impact-driven orientation by consolidating applied research results and reinforcing knowledge transfer across projects and real-world contexts.

A major achievement was the delivery of a TRL6 functional prototype under the DBoidS project, integrating cooperative UAVs, boid-based autonomous guidance, Digital Twins, AI-augmented reality, and interoperable monitoring and simulation systems to support wildfire prevention and response. Additional contributions included citizen science platforms (JellyfishGO!, ILIAD), human-in-the-loop models for the

data economy (NOUS), personalised dashboards for Digital Twin decision-making (FRODDO), and research on digital phenotypes for early detection of anxiety and depression, including the analysis of confirmation bias risks in large language models applied to clinical decision support (HfPT).

In the domain of AI-mediated education, the area operationalised a Cognitive Ecosystems perspective by integrating an institutional digital transformation framework developed within OpenEU fieldwork with reusable AI-supported literature review workflows and structured AI co-teaching practices. These approaches were disseminated through scientific publications and open educational resources, culminating in an invited presentation at the Harvard–EdUHK–Stanford joint symposium, strengthening international collaboration. The team also designed and evaluated a large language model–based chatbot prototype to support self-regulated learning in software engineering education, and piloted capacity-building initiatives for staff and students on AI-assisted studying and literature review processes, translating research outcomes into scalable and adoptable educational practices.

These activities resulted in multiple scientific publications and strengthened the group's engagement in leading international HCI communities, including ACM SIGCHI, IFIP TC13, HCII, CSCW, UbiComp/ISWC, and COST Action Relink2, reinforcing European collaboration and scientific visibility.

Software Engineering (ES). In 2025, the Software Engineering area advanced a diverse research agenda spanning federated systems, privacy-preserving architectures, human oversight in automated processes, and emerging AI-based system engineering. Within the Inno4Vac project (IMI2/EU), researchers contributed to the design and implementation of federated repositories and privacy-preserving mechanisms supporting distributed machine learning. In the NOUS project, work focused on integrating human oversight into automated data standardisation processes.

Research on Developer Experience, microservice architectures, agile methods for aerospace systems, and the engineering of LLM-based systems - developed in collaboration with ProDEI doctoral students - culminated in a completed PhD thesis. The area also consolidated strategic expertise in the engineering of LLM-based systems, strengthening institutional capacity in this rapidly evolving domain. Members of the group contributed to the international community through conference organisation, including XP 2025.

Special Purpose Computing Systems/Embedded Systems (LASPeCS). In 2025, we began work on two new European projects (DARE and POEMS), focused on state-of-the-art compilation technologies for high-performance computing and on the development of a competence centre for the semiconductor sector. Two additional projects in which we will participate (ODE4EC-PIV and ODE4EC-DIG) were also approved. These projects focus on open toolflows for EDA design in Europe. We developed a new approach to addressing the MISRA-C standard. Instead of only detecting whether a given C source code complies with the standard, we can now automatically suggest and apply code modifications, incorporating user-provided input when necessary. We have also expanded the range of supported languages and can now analyse and transform Fortran code using our framework. We partnered with NVISION and successfully applied our technology to automatically adapt C code to use an AI-oriented RISC-V extension developed by the company. We began investing in the ONNX format, an open standard for representing AI models. We now have a working framework for transforming and testing ONNX models, enabling their offloading to custom accelerators. Finally, we developed an innovative approach for full-system-on-a-chip simulation, enabling arbitrary accelerator simulators to be attached to a full-system simulator, thereby improving the testing and development workflow.

Computer Graphics and Interactive Digital Media (CGIDM). In 2025, research in Computer Graphics and Interactive Digital Media focused on Extended Reality (including multisensory VR and AR) and 3D multimodal interaction, advancing immersive visualisation and analytics, immersive learning environments, procedural content generation, and haptic interaction technologies. Alongside fundamental research, the group developed applied immersive solutions and intuitive authoring tools targeting industry, defence, cultural heritage, tourism, education, and public administration.

Within the Blue-X European project, XR-based decision-support tools were developed to optimise planning and execution across all phases of blue renewable energy projects. In the emerging area of defence, participation in the European Defence Fund project Battleverse expanded the application of immersive and visual analytics technologies to integrated wargaming and operational simulation environments. In this context, the group contributes advanced decision-support dashboards, immersive XR visualisation, and

expertise in service interoperability and systems integration, supporting the orchestration of heterogeneous data sources and simulation models and enhancing situational awareness throughout the operational lifecycle.

The team strengthened both internal and international collaborations, including joint initiatives with iiLab in advanced Industry 4.0 and 5.0 training programmes. International capacity-building activities included a course on serious games for health and well-being at Ludwig Maximilian University (EUGLOH framework) and training in 360° video production in Mozambique.

Scientific dissemination remained strong, with publications in high-impact venues in Virtual Reality and IEEE conferences, addressing topics such as digital twin interoperability, multisensorial VR, virtual choreographies, and 3D reconstruction and interaction methodologies. The group organised major international events, including ICGI 2025 and VISIGRAPP 2025, and maintained active roles on international scientific boards such as EUROGRAPHICS and the IEEE Digital Twin of the Earth Working Group. Recognition of excellence included the inclusion of a researcher in the Stanford/Elsevier Top 2% Scientists list and the award of a best international conference paper.

Innovation outcomes in 2025

Geospatial Information Systems Engineering. In 2025, the area achieved significant innovation outcomes across multiple nationally and internationally funded initiatives. Within the TEXPACT project (RRP), a comprehensive IoT-based architecture was implemented to monitor young athletes' performance metrics in near real time. The solution integrates sensor technologies, edge-to-cloud data pipelines, and user-friendly mobile interfaces, enabling the collection, analysis, and visualisation of biometric data through digital dashboards that support personalised and data-driven training decisions.

Under the FAIST project (RRP), artificial intelligence components were successfully embedded into digitally transformed software solutions for the footwear industry. By integrating AI-driven automation and process optimisation into existing industrial workflows, the project demonstrated how targeted digitalisation can modernise traditional manufacturing sectors and enhance operational efficiency.

The Capta project (Interreg POCTEP) advanced the development of an interactive and interoperable platform for the visualisation of climate change and blue carbon indicators along the Portugal–Galicia coast, supporting collaborative environmental monitoring and indicator management.

In the DevSecPaaS TestBed (RRP), a secure, cloud-native platform was developed to support end-to-end software development lifecycles. The platform integrates artificial intelligence capabilities at its core, including the orchestration of private small language models (sLLMs), ensuring secure and privacy-aware AI adoption in sensitive development environments.

Finally, the XARPER Retail project (Portugal 2030) is advancing XR- and AI-based solutions for the retail sector, combining generative models (e.g., stable diffusion) for virtual try-on with transformer-based recommendation systems to enhance digital customer experiences.

Earth, Ocean, and Space Science (EOSS). In 2025, the area consolidated its position in interoperable Digital Twins of the Ocean. The successful conclusion of H2020 ILIAD delivered significant advances in interoperability, tool and workflow reusability, and execution across heterogeneous computing platforms, addressing key bottlenecks in the orchestration of distributed digital twin components. Project outcomes contributed to OGC-related interoperability discussions and were highlighted at the 4th Digital Ocean Forum, reinforcing international visibility and alignment with the European Digital Ocean vision.

Work continued in BLUE-X, where Extended Reality–based decision-support tools are being developed to optimise decision-making in blue renewable energy projects. Advanced event-driven virtual choreographies were implemented to enable interoperable digital twin behaviours in complex ocean scenarios, such as oil spill response. Contributions to NOUS and FRODDO further strengthened the group's role in Human-Centred AI applied to digital twin ecosystems.

The area maintained active engagement in international standardisation processes, notably within the IEEE P3501 Digital Twins of the Earth Working Group, and reinforced global positioning through collaboration with DITTO under the UN Decade of Ocean Science. Strategic partnerships with European research and

industrial organisations were consolidated, while internal collaboration enhanced capabilities in sensing, distributed systems, and scalable infrastructures for Digital Twins and Data Spaces.

Operational impact progressed through the NewSpace Portugal initiative, where a Data Space use case evolved into a functional demonstrator supporting subscription-based data asset generation. Capacity building was strengthened through new PhD scholarships and preparatory work on foundational ocean–air interface models. Multiple European project submissions, including to FCT and CINEA, confirm the area's scale-up trajectory, focused on innovation with impact and on enhancing informed decision-making in ocean, maritime, earth, and space systems.

Personalised Health Research (PHR). In 2025, the area achieved significant advances in large-scale studies, privacy-preserving AI, and federated health infrastructures. Within the RECONNECTED project, the CEMA study was successfully completed, involving 3,150 participants across nine countries and applying a complex systems approach to mental health determinants and outcomes. Building on this foundation, a clinical trial is being prepared to deliver reinforcement learning–based personalised micro-interventions, supported by the implementation and cultural adaptation of 110 interventions. The Moodbuster 2.0 online intervention framework was extended to support both large-scale observational and interventional studies.

In PHASE IV AI (HEU), new privacy-preserving machine learning methods are being developed to enhance secure data access and availability for AI-driven health innovation. In the IHI Inno4Vac/VAXPRED project, the in-silico vaccine development platform was strengthened through new analytical tools for immunological repertoire data and improved computational models for immunogenicity prediction.

The HEU IMPROVE PRETERM project expanded a federated European infrastructure integrating data from more than 23 birth cohorts, incorporating additional neonatal networks from Switzerland and Germany to support research on early-life interventions. Within Health from Portugal (RRP), the team contributed to the design of FAIR-compliant health data management systems, AI-enhanced privacy-preserving data-sharing tools, and interoperable digital health platforms aligned with HL7 standards. Technological innovation also included the development of a smart wearable textile embedding high-density electromyography sensing capabilities, reinforcing translational impact in digital health.

Information Systems and Applied Computing (ISAC). ISAC conducts research across Enterprise Computing, Data Management Systems and Applications, and Digital Business and Learning, integrated under the central research line of Intelligent Organisational Ecosystems. This framework focuses on data-driven organisational transformation, digital governance, and ecosystem-based innovation models.

In 2025, this agenda was advanced through major applied projects. The BankDigitalTransf project, concluded in February 2025, delivered a comprehensive enterprise architecture and structured transformation plan for Banco Português de Fomento, providing strategic guidance for its digital evolution. The BankRoad2DataMgm project further consolidated data governance practices in the banking sector, enhancing compliance with European Central Bank reporting frameworks, including BIRD and IReF, and reinforcing ISAC's positioning in regulatory-driven data management.

The Intelligent Organisational Ecosystems approach was extended to Smart Territories through two new initiatives developed with intermunicipal communities in Tâmega e Sousa and Terras de Trás-os-Montes. These projects aim to design and implement digital governance models and integrated regional pilots, translating research into operational regional innovation ecosystems.

Scientific output remained strong, with the completion of two PhDs, supervision of more than ten MSc dissertations, and the publication of over 30 articles, predominantly in first-quartile journals. Overall, ISAC continues to combine applied research, strategic consultancy, and academic development, reinforcing its impact in financial services, data governance, and smart regional transformation.

Activity Overview

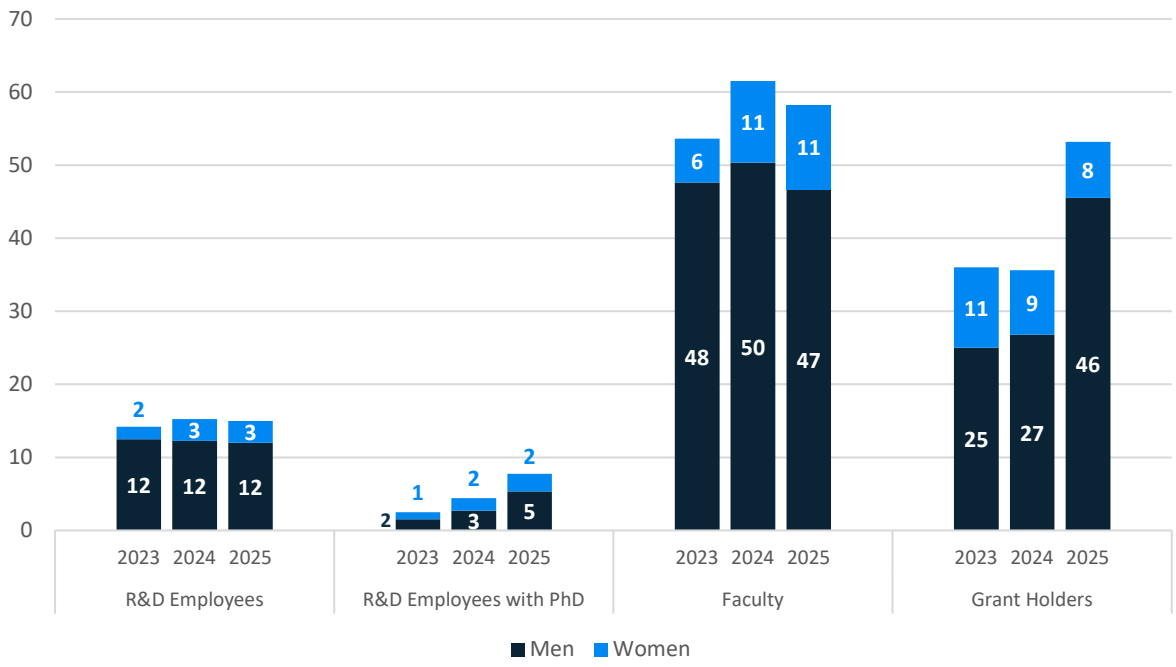


Figure 8.28 - HumanISE - Research team evolution (Person-years)

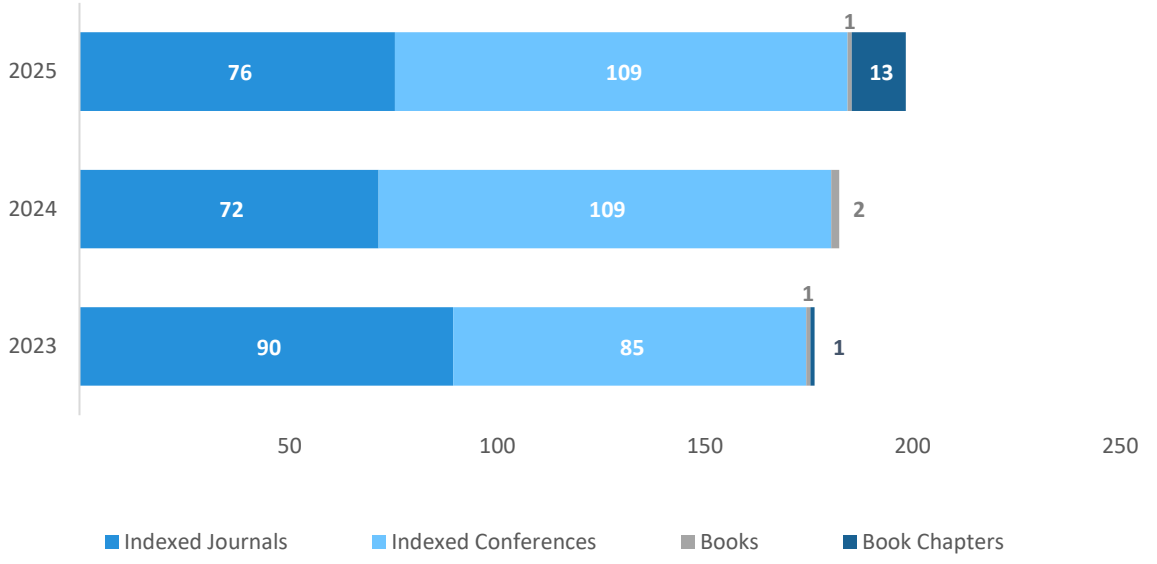


Figure 8.29 - HumanISE - Evolution of publications by members of the Centre (consolidated data)

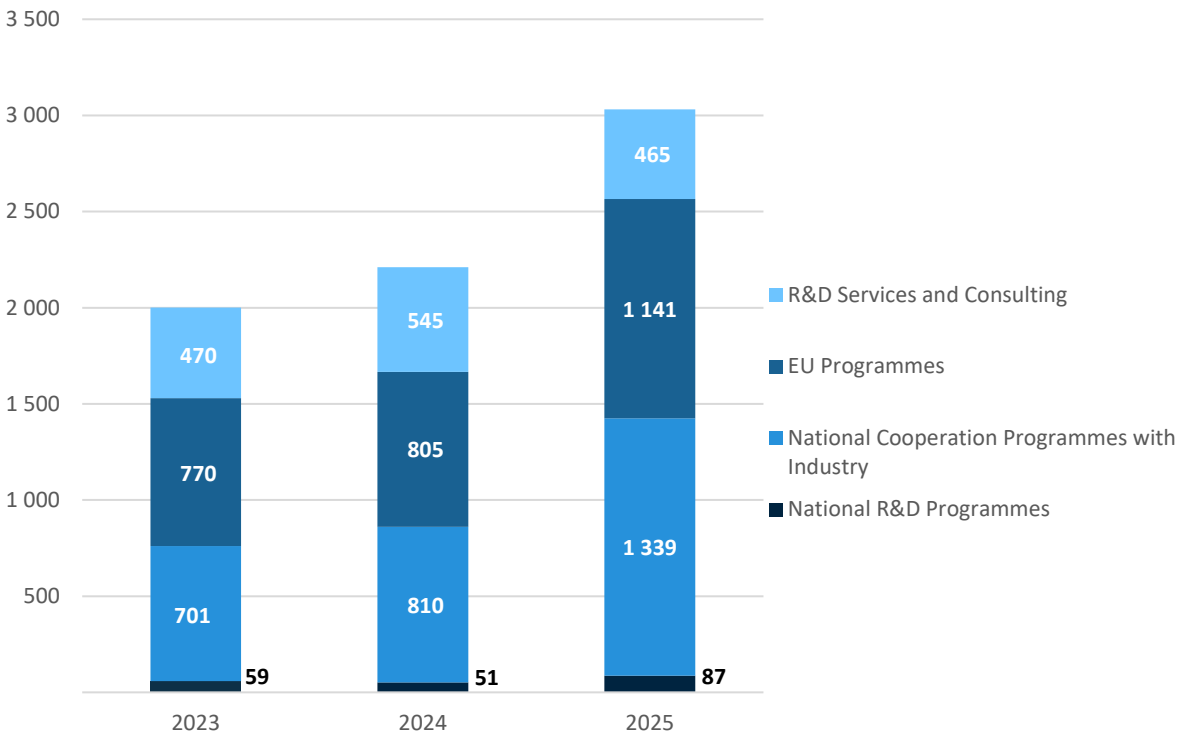


Figure 8.30 - HumanISE - Project funding evolution (k€)

8.11 LIAAD - ARTIFICIAL INTELLIGENCE AND DECISION SUPPORT LABORATORY

Coordinator: Alípio Jorge

Assistant to the Centre Coordinator: Joana Dumas

Presentation

The scientific foundations of LIAAD are machine learning, statistics, optimisation and mathematics, focusing on Intelligent and Adaptive Systems and Mathematical Modelling in Decision Support.

LIAAD produces high-quality, cutting-edge research at the international forefront of our research areas and promotes the transfer of knowledge and technology. The Centre has been working in Machine Learning and Data Science since 1991, soon after that including Optimisation and Mathematical Modeling. The huge amount and variety of collected data and the ubiquity of sensory and computational devices offer opportunities and challenges to scientists and engineers. On the other hand, the demand for adaptive intelligent decision support is spreading in all areas of activity, motivating our investment in different approaches to modelling. Currently, the growing impact of Artificial Intelligence (and of Machine Learning) in our lives demands a finer attention to response quality, sustainability, responsibility and human interaction. Our research lines help shorten the gap between collected data and useful data, offering diverse modelling and methodological solutions including generative AI, as well as bringing more transparency and meaning to Artificial Intelligence.

By the end of 2025, LIAAD had a total of 148 members (including external students and collaborators), comprising 47 core researchers, 24 grant holders, and 42 trainees. 23 of the researchers were Academic staff, mostly from the University of Porto, but also from P. Porto, U. B. Interior, I. P. Viana do Castelo and I. P. Leiria.

Research outcomes in 2025

Develop impactful research and innovation aligned with the SDGs

The projects PTICOLA (google cloud platform), StorySense (FCT) and CitiLink produced a number of **NLP** resources for European Portuguese, such as Enhancing Portuguese Variety Identification with Cross-Domain Approaches (AAAI 2025, A*); Tradutor: Building a Variety Specific Translation Model (AAAI 2025, A*); MedLink: Retrieval and Ranking of Case Reports to Assist Clinical Decision Making (Best Demo Paper ECIR 2025) – Health; and Physio: An LLM-Based Physiotherapy Advisor (Best Demo Award ECIR 2025) – Health.

In the field of **narrative extraction**, PolyNarrative: A Multilingual, Multilabel, Multi-domain Dataset for Narrative Extraction from News Articles was published in ACL (A* venue), and NarratEX Dataset: Explaining the Dominant Narratives in News Texts in EMNLP (also A*).

In the field of **core AI,** LIAAD won the paper Read-write LSTM: A Novel Approach Integrating Backpropagation to Data in LSTM was published in ICDM 2025 (A* venue).

In SpatioTemporal AI, Salvador Urban Network Transportation (SUNT): A Landmark Spatiotemporal Dataset for Public Transportation, Nature Scientific Data (Q1) – Sustainable Cities.

In the field of **Realtime AI**, Fish swarm parameter self-tuning for data streams, DMKD (Q1); Histogram approaches for imbalanced data streams regression, Machine Learning (Q1); Modeling events and interactions through temporal processes: A survey, NeuroComputing (Q1); Online learning from drifting capricious data streams with flexible Hoeffding tree, Inf.Proc. Man.d (Q1); RMIDDM: an unsupervised and interpretable concept drift detection method for data streams, DMKD (Q1).

In the field of **Responsible AI**, A Multidimensional Approach to Ethical AI Auditing was published in AAAI 2025 (A*). Dr Miriam Santos has also been awarded the 2025 Cor Baayen Award for her outstanding research in data quality and ethical AI.

There were also papers in several core A venues: CIKM, ICDAR, 4 papers in ECIR, 4 papers in CLEF.

Increase our international networking, leadership and competitiveness

The team organised the **ECML-PKDD 2025**, the main European Machine Learning conference with over 1300 participants.

LIAAD researchers co-organised the Workshop on Narrative Extraction from Texts (**Text2Story'25**@ECIR), in Lucca, Italy and the **SoGood@ECMLPKDD25** workshop in Porto. LIAAD was also part of the organising committee **of SemEval 2025 Task 10**: Multilingual Characterisation and Extraction of Narratives from Online News; **JokeR Lab**: Subtask on Automatic Humour Analysis at the 16th Conference and Labs of the Evaluation Forum **CLEF'25**; **CoLIE:** Subtask on Automatic Classification of Literary Epochs at the 19th International Conference on Document Analysis and Recognition **ICDAR'25**; the **Data Streams Track** @ ACM SAC.

LIAAD was part of the program committees of SIGIR'25, CIKM'25, CLEF'25, SemEval'25, TheWebConf'25, ECIR'25, WSDM'25, COLING'25, TPDL'25. We have an editor-in-chief of the Journal of Data Science and Analytics (Springer), action editors for Information Processing & Management (Elsevier), Data Mining and Knowledge Discovery (Springer) and Machine Learning Journal (Springer).

Innovation outcomes in 2025

Develop closer and deeper relationships with our innovation partners and the broader community

The CitiLink project - Enhancing municipal transparency and citizen engagement through AI: from unstructured to structured data led to the creation of an annotated dataset of 120 Portuguese municipal meeting minutes (2021–2024) from six city councils; the Development of eight NLP models to identify and anonymize meeting participants, detect discussion subjects, associate votes, generate summaries, and organize content by municipal department; and the Launch of Citylink portal: https://citilink.inesctec.pt/. It was implemented in 6 different municipalities with several more in pipeline.

LIAAD received the Prémio ArquivoPT for the "my region portal", **"Minha Região – O Teu Portal Autárquico".**

The project XPM – eXplainable Predictive Maintenance got implemented in four different use cases in 4 countries until 2024. In 2025, related projects were conducted in companies – Caetano buses and AIOPS2 to manage buses and compute farms respectively.

Develop impactful research and innovation aligned with the SDGs

The projects PTICOLA (google cloud platform), **StorySense** (FCT) and **CitiLink** produced a number of NLP resources for European Portuguese, such as Enhancing Portuguese Variety Identification with Cross-Domain Approaches (AAAI 2025, A*); Tradutor: Building a Variety Specific Translation Model (AAAI 2025, A*); MedLink: Retrieval and Ranking of Case Reports to Assist Clinical Decision Making (Best Demo Paper ECIR 2025) – Health; and Physio: An LLM-Based Physiotherapy Advisor (Best Demo Award ECIR 2025) – Health.

The GreenGrocer EU project was initiated - Responsible Consumption. **The Emeritus EU project** was concluded – Life on Land. It gave rise to the **project EnSafe**, on environmental crime, in partnership with the Inspeção-Geral da Agricultura, do Mar, do Ambiente e do Ordenamento do Território (IGAMAOT).

The Easy4ALL project aims to develop a no-code solution that enables seamless extension of CPCIT4ALL applications - such as HR management, utility management, and portals - or the creation of new functionalities and modules using natural language, without requiring programming skills.

The Health from Portugal (HfPT) Agenda aims at positioning Portugal as a world reference hub in the design, development and production of advanced solutions for the health markets, based on innovation and technology. It aims to launch 99 new products, processes and services by 2025 with an investment of 90M€.

The project Observa – BelowWater partners with the Portuguese navy to detect vessels from signals caught by submarine cables.

Activity Overview

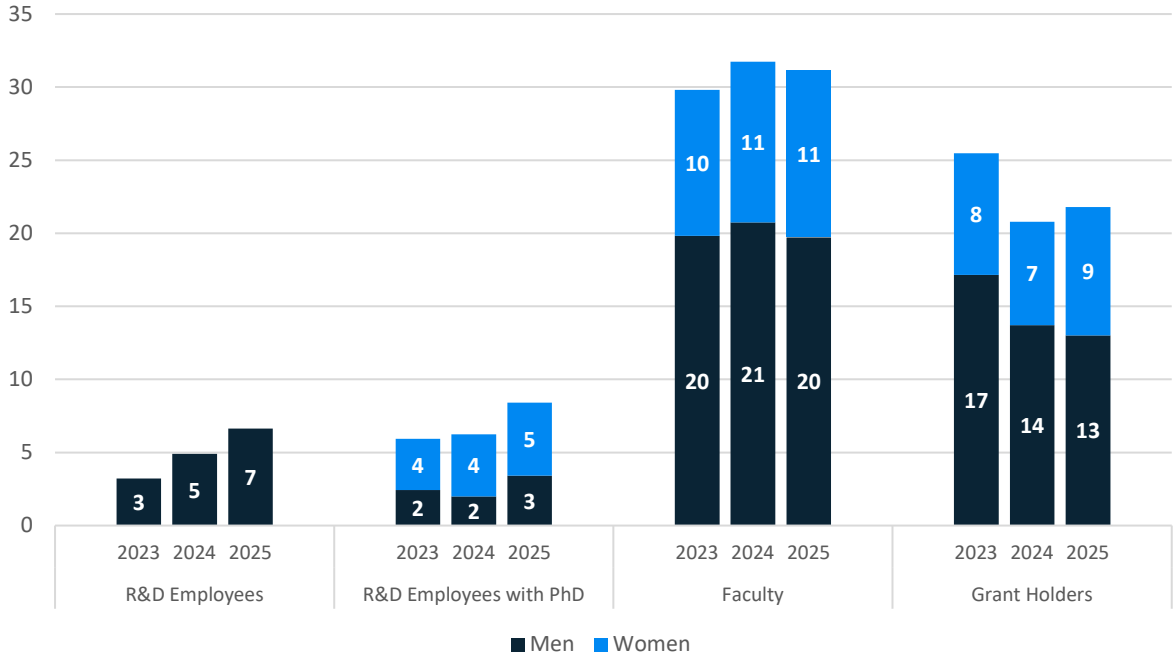


Figure 8.31 - LIAAD - Research team evolution (Person-years)

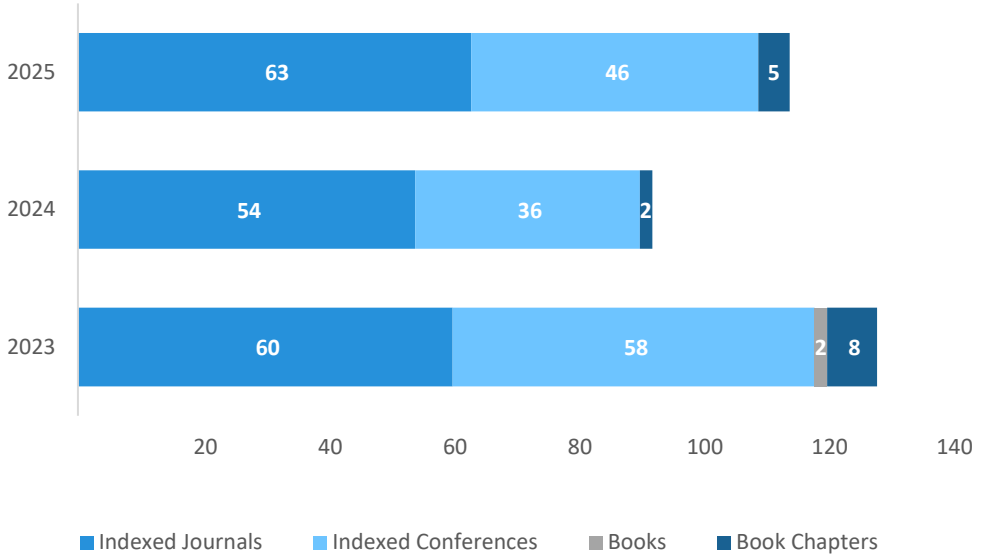


Figure 8.32 - LIAAD - Evolution of publications by members of the Centre (consolidated data)

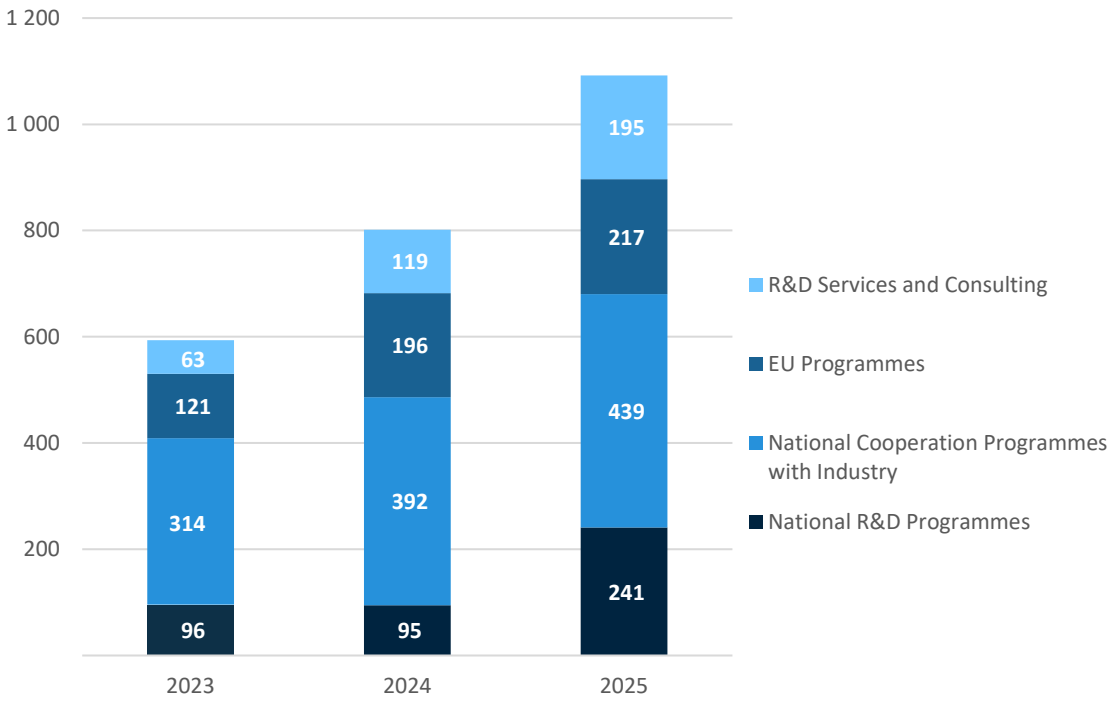


Figure 8.33 - LIAAD - Project funding evolution (k€)

8.12 CRACS – CENTRE FOR RESEARCH IN ADVANCED COMPUTING SYSTEMS

Coordinator: João Vilela

Assistant to the Centre Coordinator: Joana Dumas

Presentation

CRACS pursues scientific excellence in the areas of programming languages, parallel and distributed computing, security and privacy, information mining, with a focus on scalable software systems for challenging multidisciplinary applications in Engineering, Life Sciences, Social Networks and the Internet of Things. By the end of 2025, CRACS had a total of 42 members (including external students and collaborators), comprising 18 core researchers, 11 grant holders, and 7 trainees. 17 of the researchers were Academic staff mostly from the University of Porto, but also from I.P. Porto and I. P. Leiria.

Research outcomes in 2025

In 2025, we slightly increased our activities as editor or associated editor in journals from 7 to 8. There was a decrease in the participation in the organisation of conferences (from 5 to 3), but a relevant growth of conferences and workshops organised by the centre (from 1 to 3) and the outreach with 130 participants in such events (vs 80 last year). There was a reduction in the participation in program committees of international events by putting a focus on more relevant/high-profile events/conferences. The participation in events such as fairs remained steady. Regarding the total number of publications in indexed journals, conferences and books, there was an increase from 32 in 2024 to 43 in 2025, notably with a focus on quality with 14 out of 23 journal publications with quartile Q1. We would like to emphasise 2 publications in CORE A venues that are references in the areas of cybersecurity and data mining, namely the IEEE European Symposium on Security & Privacy and the European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML PKDD), as well as publications in journals with high impact factors such as the IEEE Open Journal of the Computer Society (IF=8.2) and the IEEE Signal Processing Magazine (IF=10.3). Finally, a noteworthy mention to the IEEE Portugal Outstanding Master Thesis Award given to Ana Catarina Gomes, currently pursuing a PhD with the centre.

In what follows, we enumerate in more detail CRACS's main research outcomes in 2025.

In the field of **IoT device security**, the RunPBA mechanism was developed and evaluated as a runtime attestation solution for microcontrollers with PAC/BTI support, including the implementation of a functional prototype and performance assessment. In parallel, the study of Function-Oriented Programming attacks on ARM Cortex-M was further advanced, identifying new exploitation surfaces and proposing mitigation strategies, with the results being published. In the area of censorship-resistant (privacy-preserving) communications, the feasibility of using TURN servers as an evasion mechanism was investigated and demonstrated through experimental analysis and prototyping. These activities aligned with the initially planned work and resulted in scientific contributions materialised in publications and prototypes.

Within **Domain-specific and context-aware** approaches to entity extraction, we consolidated our line of work on lexical drift detection and the adaptation of NLP models to specialised domains, through the implementation of a pipeline for corpus collection and pre-processing and by validating the adaptation of an LLM to the military domain (a corpus of around 300 doctrinal manuals, automatic text extraction from PDFs, cleaning, and deduplication), thus creating a reusable basis for information extraction and entity recognition tasks in operational settings.

In parallel, within **Disinformation detection**, we deepened the shift from fake news to disinformation, strengthening message characterisation using sentiment signals and emotional traits, including the modelling of emotional sequences, and initiating the integration of concept-drift adaptation mechanisms in multilabel scenarios to accommodate the evolution of discourse.

In the field of **Cyber threat intelligence** within the PRIVATEER Horizon Europe project, we have extended the development of the existing CTI sharing proxy, which now supports multiple encrypted indexes and dynamic sharing groups. Within the **Distributed shard index field**, an existing CTI sharing tool evolved to

support multiple encrypted indexes simultaneously, thus creating a Distributed Shared Index (DSI) that is resilient to the single point of failure problem of using a single index. The performance of the developed DSI approach was evaluated, achieving good results.

Lock-Freedom: Property-based testing (PBT) was employed to evaluate a concurrent lock-free data structure implemented in C, using the Haskell QuickCheck library for automated test generation. The approach modeled the behavior of the data structure through purely functional transitions within a state machine, which was then compared against the concurrent execution of the actual implementation. This work involved the development of a testing framework, the specification of the data structure and its corresponding functional model, and the assessment of the approach through experimental evaluation. Results demonstrated that state machine–based testing is effective in detecting concurrency-related errors.

Link Prediction on Quantile Graphs for Collaborative Forecasting. We initiated the development and evaluation of novel approaches aimed at designing a link prediction method specifically tailored to quantile graphs derived from univariate time series, with the goal of supporting collaborative time series forecasting. Several strategies were developed and tested to construct inverse mapping methods capable of transforming quantile graphs into synthetic interval-valued time series data. Among the approaches explored, hybrid methodologies combining quantile graphs and visibility graphs were investigated to preserve a greater amount of information from the original data.

Time Series Privacy-Preserving via Complex Networks. We developed a novel inverse mapping method to generate synthetic bivariate time series data. The proposed approach maps a bivariate time series into a two-layer graph structure (multilayer quantile graphs). Successive probability transitions (within each layer) and contemporaneous transitions (between pairs of layers) are then used to generate synthetic data that preserve relevant statistical properties of the original dataset. The method demonstrates strong performance in terms of data fidelity and utility, highlighting its potential as a promising solution for time series privacy-preserving applications.

Within the scope of research on Heterogeneous **Parallel Computing** with Multi-core CPUs and iGPUs, scheduling and load distribution strategies between multi-core CPUs and integrated GPUs were studied and evaluated, with a focus on efficiency and the use of heterogeneous resources. This work culminated in the development and completion of a master's thesis, consolidating experimental results and methodological contributions in the area.

Innovation outcomes in 2025

In what follows, we enumerate CRACS's main innovation outcomes in 2025.

- Distributed shared index. An efficient Distributes Shared Index (DSI) tool to support CTI sharing can minimize disruption and maintain its operation even when attacked. Sharing data with searchable encryption need some form of encrypted indexing and common approaches make use of a single index. This creates a single point of failure. Using a CTI sharing context, we evolved the previous solution to make use of multiple, distributed, encrypted indexes. Such solves the single point of failure, but also improve the overall system performance, reduces average response times and the system resilience against denial-of-service attacks.
- Multidisciplinary applications of MLMs. A machine learning model (MLM) was developed with a novel approach to the problem of indoor localisation and the development of indoor positioning systems (IPS). The IPS uses both MLMs based both on Bluetooth (BT) radio signals, from a BT beacon infrastructure, and on video frames opportunistically captured with the smartphones of visitors. The Indoor Positioning System (IPS) was implemented and prototyped.

Activity Overview

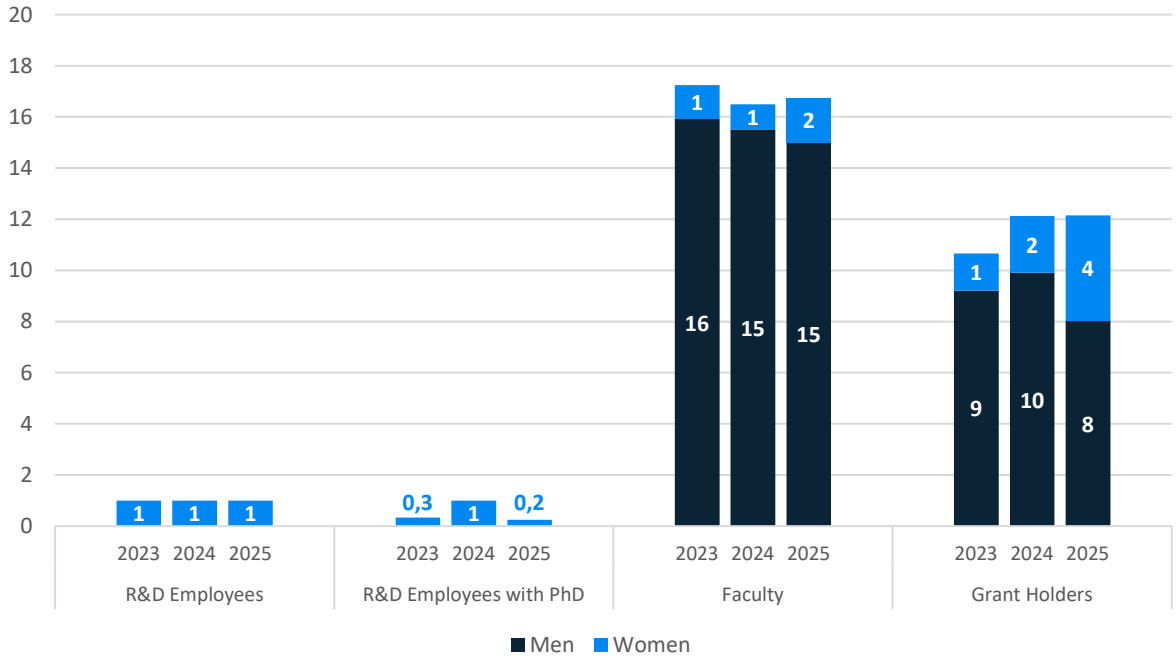


Figure 8.34 - CRACS - Research team evolution (Person-years)

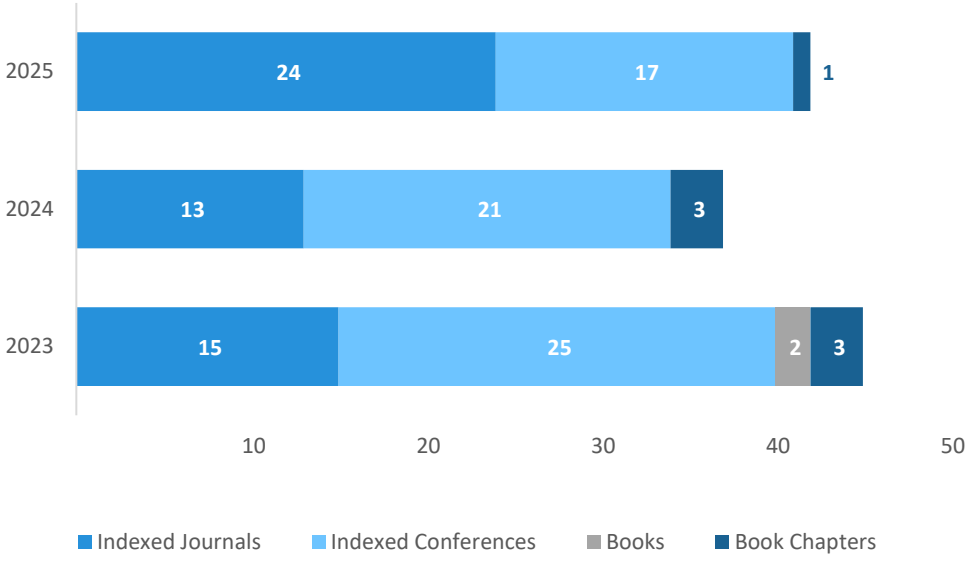


Figure 8.35 – CRACS - Evolution of publications by members of the Centre (consolidated data)

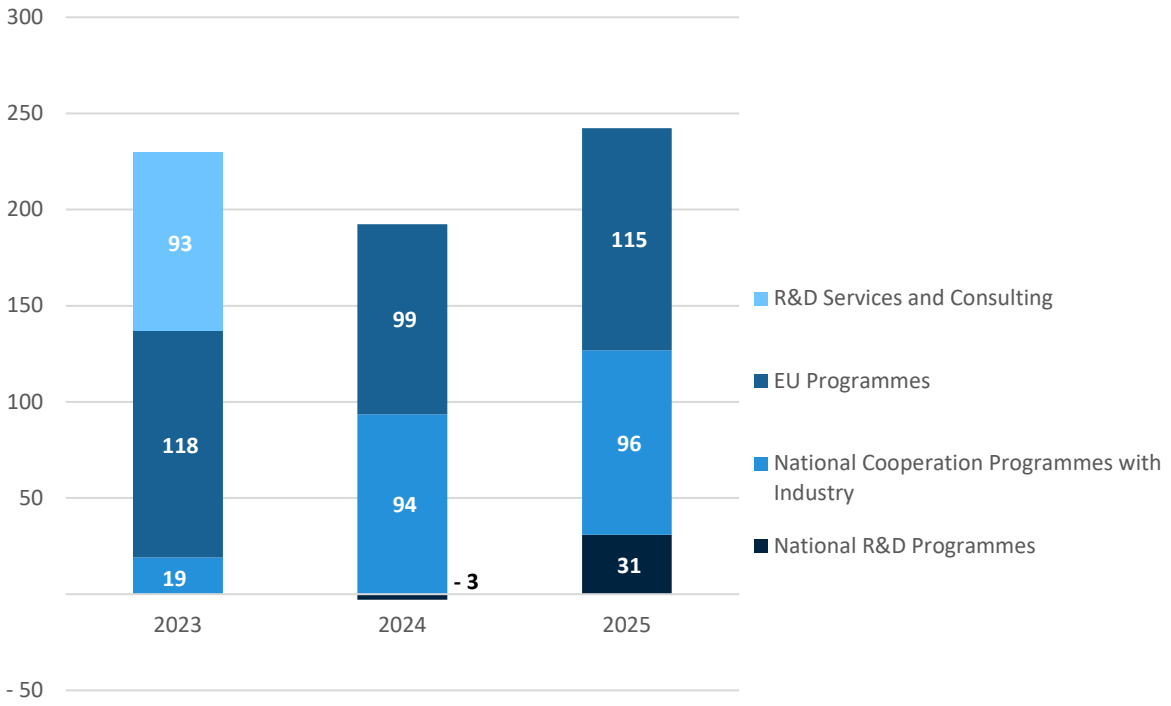


Figure 8.36 - CRACS - Project funding evolution (k€)

8.13 HASLAB - HIGH-ASSURANCE SOFTWARE LABORATORY

Coordinators: Alcino Cunha and António Luís Sousa

Assistant to the Centre Coordinator: Catarina Leones Fernandes

Presentation

- HASLab is focused on the design and implementation of high-assurance software systems: software that is correct by design and resilient to faults and malicious attacks. To accomplish this mission, HASLab covers three main competencies within INESC TEC's Computer Science domain - Software Engineering, Distributed Systems, and Information Security - complemented by other competencies such as High-Performance Computing, Human-Computer Interaction, Programming Languages, Quantum Computing or the Theory of Computation. In particular, HASLab's research focuses on three main research lines:
- **Software Engineering:** methods, techniques, and tools for rigorous software development that can be applied to both classical and novel quantum computing architectures;
- **Distributed Systems:** improving the reliability and scalability of software by exploring properties inherent to the distribution and replication of computer systems;
- **Information Security:** minimising the vulnerability of software components to hostile attacks by deploying structures and cryptographic protocols whose security properties are formally proven.

Concerning innovation, HASLab aims to provide solutions that combine theory, methods, languages, and tools to develop complete ICT systems that provide strong, high-assurance guarantees to their owners and users.

Research outcomes in 2025

In 2025, HASLab continued producing high-quality research with renowned international partners, including academia and IT companies. Compared to last year, we have significantly increased both the number of publications and the quality of the venues in which they were published. The team published 77 scientific publications, of which 49 were conference papers (including 5 CORE A* and 8 CORE A) and 28 journal articles (including 16 Q1 and 8 Q2). Among the publications in top venues, we highlight the following:

- The paper "Reducing measurement costs by recycling the Hessian in adaptive variational quantum algorithms" was published in the journal Quantum Science and Technology and aims to make adaptive variational quantum algorithms more efficient, thus reducing computational costs and making quantum computing more accessible and efficient;
- The paper "Heuristic-free Verification-inspired Quantum Benchmarking" was published in Quantum Science and Technology and presents a new approach to quantum benchmarking – the process of testing and evaluating the performance of quantum computers;
- The paper "Assessing the information security posture of online public services worldwide: Technical insights, trends, and policy implications" was published in Government Information Quarterly and carried out a study to evaluate the external security posture of 3,068 digital public service platforms between 2023 and 2024;
- The paper "CRDV: Conflict-free Replicated Data Views" was published at SIGMOD 2025 and presents a new model for conflict-free data replication adapted to the relational paradigm, such as SQL, in which data are organised into tables with rows and columns;
- The new tool, called Gyosa, was presented in the leading journal IEEE Journal of Biomedical and Health Informatics, which can conduct genomic studies securely in cloud computing environments without compromising data privacy;
- The paper "Keigo: Co-designing Log-Structured Merge Key-Value Stores with a Non-Volatile, Concurrency-aware Storage Hierarchy" was presented at VLDB 2025 and introduces a new storage

system that proposes a new way of managing and storing information in data centres, maximising the performance of modern hardware.

In terms of distinctions and awards, we highlight the Amazon Research Award granted to Alexandra Mendes for the project "Overcoming Barriers to the Adoption of Verification-Aware Languages." The project aims to identify and address the key obstacles limiting the adoption of programming languages that support formal verification, with particular emphasis on the Dafny language, thereby contributing to more reliable and trustworthy software systems.

Scientific excellence was also recognised internationally. The paper "CRDV: Conflict-free Replicated Data Views" received an Honourable Mention at SIGMOD 2025, one of the world's leading conferences in data management, ranking among the four best papers out of approximately 250 submissions.

In the field of quantum computing, our researchers, in collaboration with a colleague from INL, achieved second place at PQHack 2025 as Team Quantum SHEmulation. The proposed solution demonstrated strong interdisciplinary potential, with prospective applications in neuroscience, seismology, ecology, and finance.

Concerning research projects, 2025 marked the launch of several strategic initiatives. We kicked off the BANKSY project, funded by the Portuguese Foundation for Science and Technology (FCT), which aims to innovate how we address environments characterised by incomplete, uncertain, or even contradictory information. In parallel, the ADAPQO project, developed in collaboration with Carnegie Mellon University (CMU), began tackling the efficiency and scalability challenges of data-processing systems that underpin such applications. During the same period, the DisaggregatedHPC project was initiated, alongside other new projects including Verifixes, Infragov, and Insieme. It is worth highlighting that several of these initiatives were developed in close collaboration with other R&D centres within INESC TEC, reinforcing our interdisciplinary and cross-centre engagement.

At the international level, we participated in the EU–LAC Supercomputing Network, formally launched at the Global Gateway Forum in Brussels. This network aims to advance the design, development, and adoption of supercomputing infrastructures across Europe, Latin America, and the Caribbean, strengthening transatlantic cooperation in HPC.

During the same period, we successfully concluded several projects. The Ibex project advanced mathematical methods for modelling and analysing flaws in cyber-physical software systems, while ExaSimple reached completion with significant contributions to high-performance computing methodologies to AI training and inferencing, in cooperation with the blueOasis SME. The Enershare project, carried out in collaboration with CPES, delivered a reference architecture to enable secure, interoperable data sharing in the energy sector. Additionally, CircThread, developed with CESE, concluded with results focused on data and information management solutions to support circular economy processes.

Regarding proposal activity, HASLab coordinated a Horizon Europe proposal with CPES and CRIIS under the HORIZON-CL4-2025-04-DATA-02 call. The proposal explored the adoption of Artificial Intelligence across the compute continuum, with use cases in energy, robotics, industry, and personal care. We are currently refining the project for resubmission, building on the feedback received.

Concerning internationalisation, we highlight the visit of 2 researchers from the EUA and Ireland as part of the 2nd edition of the INESC TEC International Visiting Researcher Programme. HASLab has hosted several international researchers from Copenhagen, Iceland, Japan, and Denmark. In addition, members of our team have held visiting periods at McGill University (Canada), the National Institute of Informatics (Japan), and CENTRA (Taiwan). HASLab also continues to strengthen its partnership with the CENTRA network, focusing on supercomputing, storage, and Artificial Intelligence. We highlight the partnerships with AIST and NIAR, as well as with McGill and FIU, in the areas mentioned above.

HASLab organised the International Symposium on Reliable Distributed Systems (SRDS 2025), held from 29 September to 2 October 2025, marking the 44th edition of this initiative.

In 2025, 6 students concluded their PhD (one was hired as an Assistant Researcher), and we had 4 new PhD students. Finally, we also highlight the 2nd "PhD Bytes" initiative, which aimed to encourage effective science communication, introduce different lines of research and promote interdisciplinary dialogue

among researchers in the field of high-assurance software. In this 2nd edition, Diogo Ribeiro, a PhD student in information security, presented a project focused on non-authoritative digital identification systems, an alternative to traditional centralised models for issuing identity documents. Regarding scientific human resources, we would like to highlight our strong performance in securing FCT PhD scholarships, with HASLab leading in this regard. We also secured three tenure-track appointments.

Innovation outcomes in 2025

Regarding innovation, the main highlight of 2025 was the project with the Smart Grid Interoperability Laboratory of the Joint Research Centre (JRC) - the EC's science and knowledge service that supports public policy development – to train the technical staff in semantic interoperability, a key technology for the digitalisation of Europe's energy sector. The same scientific results are now also exploitable as an open-source project supported by the Linux Foundation for Energy (LFE). This project was in collaboration with CPES. In terms of impact in the community, we highlight the work on the project "Linha de Saúde 24h", where we have continued to deploy advanced technologies and optimise services through a free healthcare telephone service for the population of Guinea-Bissau. The PETALL project, which won second place in the 4th edition of the IN3+ Award, is developing a prototype to enhance usability and scalability. Also, the project ATAI, which developed innovative technological solutions based on disruptive technologies - Machine Learning (ML), Artificial Intelligence (AI), Big Data, and Security - positively impacting operations in the service industry, especially workforce scheduling in hotels and restaurants, was concluded. Finally, the project Testbed, which consists of a cybersecurity assessment of Autonomous Mobile Robots directly connected via 5G networks, also came to an end in 2025.

Activity Overview

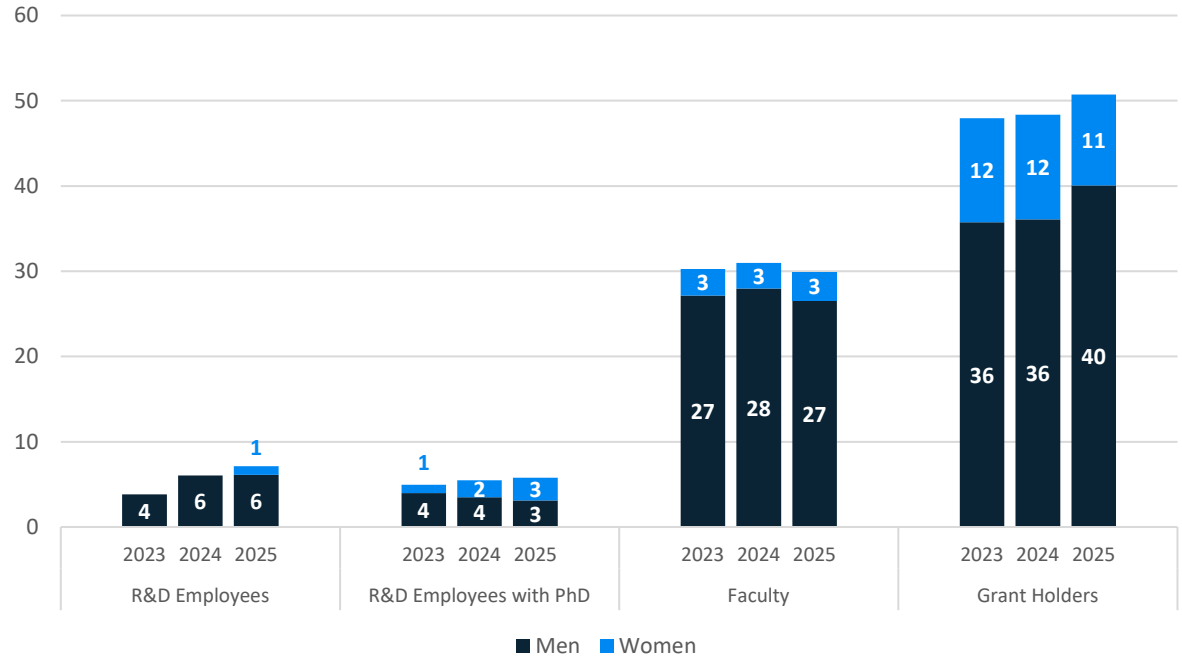


Figure 8.37 - HASLab - Research team evolution (Person-years)

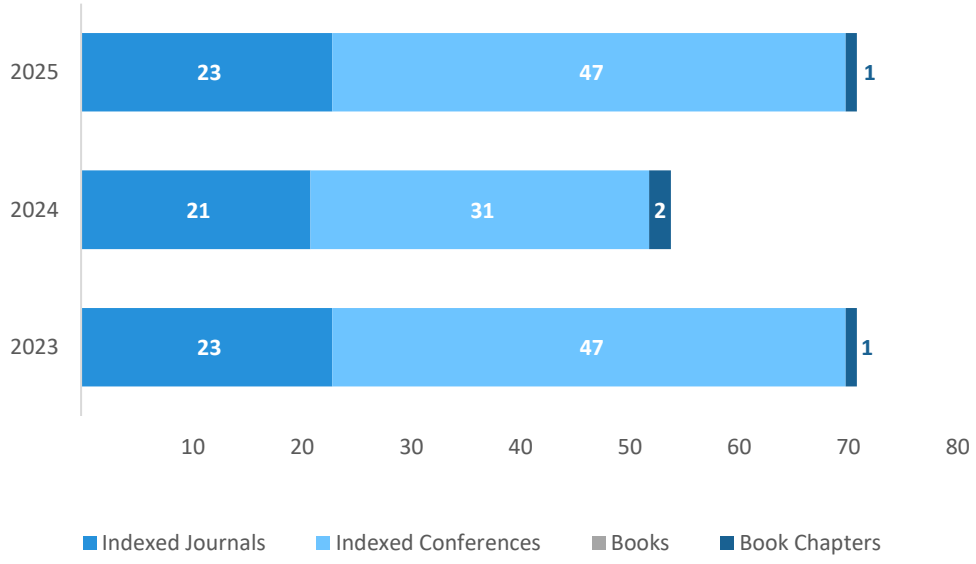


Figure 8.38 - HASLab - Evolution of publications by members of the Centre (consolidated data)

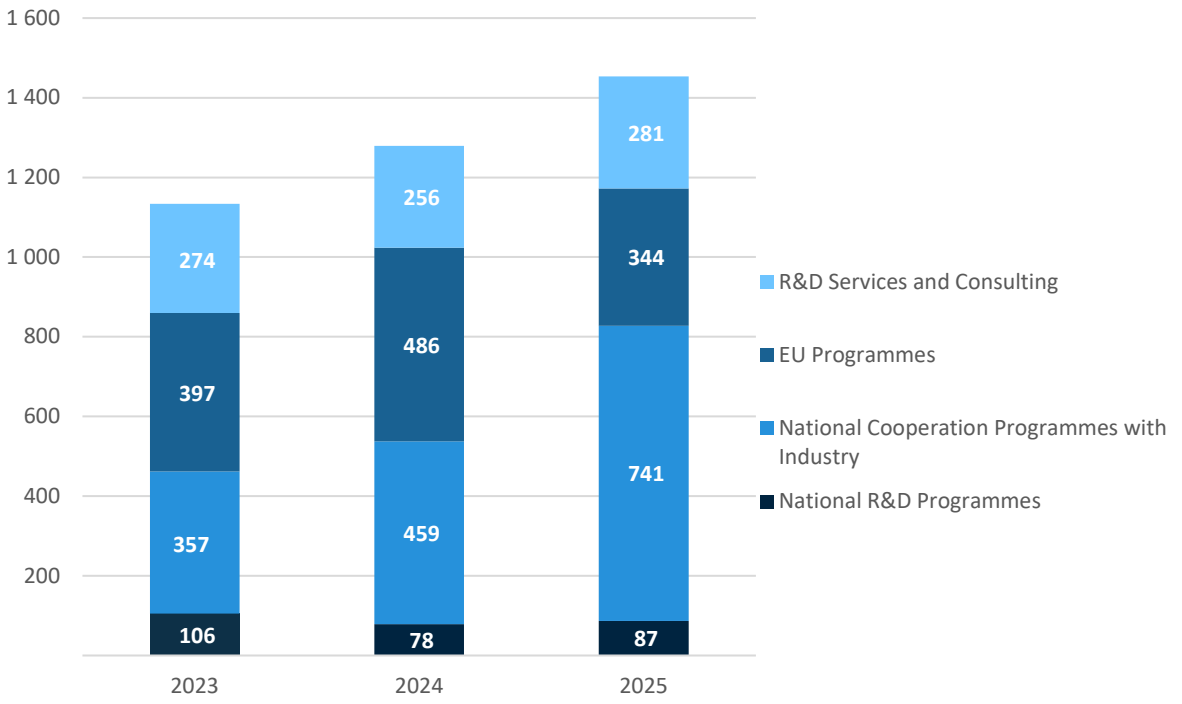


Figure 8.39 - HASLab - Project funding evolution (k€)

9 SPECIAL PROJECTS

9.1 UT AUSTIN Portugal Program

Coordinators: José Manuel Mendonça and Rui Oliveira
Executive Director: Andreia Passos
Senior Officer: Vera Pinto

Presentation

At the close of 2024, the UT Austin Portugal Program reached a defining milestone. The Portuguese Government formally approved the renewal of its strategic partnerships with the U.S. Universities for a further six-year period (2025-2030), following a positive independent audit commissioned by FCT. The evaluation recognised the sustained impact of the three Partnerships over nearly two decades and recommended their continuation, affirming their strategic relevance for Portugal's scientific, technological, and entrepreneurial development.

The renewal of the Partnership marks not only continuity, but evolution. Since the launch of the collaboration in 2007, Portugal has undergone a profound transformation in its scientific capacity, innovation ecosystem, and international positioning. At the same time, the global research and innovation landscape has evolved significantly, becoming more competitive, more mission-oriented, and increasingly shaped by strategic technological priorities.

Phase 4 aligns the Program's priorities with emerging European strategic agendas, reinforcing Portugal's role in global research networks while addressing critical technological challenges. Clean energy systems, advanced computing and AI, critical materials, and Space–Earth technologies define the next stage of collaboration - areas where Portugal demonstrates emerging or consolidated strengths and where structured collaboration with UT can generate high-impact outcomes. Therefore, Phase 4 positions Portugal not merely as a participant in global research networks, but as a co-leader in shaping technological agendas, while recognising UT Austin's thought leadership in those areas.

The Program's architecture in this new phase reflects a structured and integrated pipeline: strategic and exploratory research generate cutting-edge knowledge; doctoral mentoring, scientific exchanges, and advanced training develop globally competitive talent; and entrepreneurial and business development support accelerates commercialisation readiness, company growth, and market expansion. Phase 4 establishes the UT Austin Portugal Program as:

- A flagship model of international, mission-driven scientific cooperation.
- A catalyst for deep-tech talent formation.
- A bridge between academic excellence and economic value creation.
- A strategic instrument aligned with Portugal's long-term R&D, industrial, and European policy objectives.

Main Achievements in 2025

In 2025, INESC TEC continued to serve as the host institution for the UT Austin Portugal Program in Portugal, providing, through the joint leadership of José Manuel Mendonça and Rui Oliveira, and the SRI team, critical strategic, negotiation, and operational support to the partnership between FCT and UT Austin. This continuation reflects recognition of the institution's proven competence in leading science and technology initiatives with top-tier international partners, initiatives poised to deliver transformative impact for the country and strengthen its standing in global scientific and innovation arenas.

More than a procedural transition, 2025 marked a year of strategic recalibration and strengthened governance. The initial months were dedicated to close coordination with the Secretary of State, FCT and the other two Partnerships - CMU Portugal and MIT Portugal - to refine the regulatory frameworks and operational instruments required to implement Phase 4 and shape up a new governance framework that would be approved in March through a resolution of the Council of Ministers.

While this framework calibrated, the Program advanced its research, education and innovation instruments. Calls were launched, new training initiatives were introduced, and community engagement activities organised.

The launch of the Training Academy represented a structural investment in advanced skills development and executive education for Portugal's research and entrepreneurial community. Developed in collaboration with leading units at The University of Texas at Austin, including the Texas Engineering Executive Education (TxEEE) and the McCombs School of Business, the Academy delivered specialised short courses, immersive and interdisciplinary hands-on training, including experiential learning aboard a research vessel. Offered in hybrid and online formats, these initiatives reached researchers, doctoral candidates, students, aspiring entrepreneurs, and industry professionals during the first year of Phase 4.

Research collaboration remained central to the Program's mission. At the beginning of the year, 19 projects funded under the 2022 Exploratory Research Projects (ERP) Call were active and under close monitoring. The portfolio expanded significantly with the selection of sixteen new transatlantic initiatives under the 2024 ERP Call. Eight of these projects advanced through an alternative funding mechanism, demonstrating a firm commitment to safeguarding scientific excellence when conventual funding routes fall short. Towards the end of 2025, the Program further reinforced its research pipeline with the launch of the 2025 ERP Call, whose results shall come out in 2026.

Mobility and researcher development were further strengthened through the Short-Term Research Internships initiative, meant to enable a new batch of Portuguese researchers to work directly with leading faculty and access state-of-the-art facilities at UT Austin this time for longer periods (up to six months). To a significant extent, the successful implementation of the 2025 cohort also reflects INESC TEC's accumulated experience in designing and managing high-quality mobility instruments (e.g.: IIVRP). In September, the Program put forward to FCT a proposal to launch a 12-month mobility scheme at UT, exclusively targeting doctoral candidates from Portuguese universities. Selected students would benefit from co-advising, transatlantic supervision, and immersion in a high-impact research environment as UT.

The Program's growing maturity was equally evident in the consolidation of its innovation agenda. The launch of TechLaunch, inspired by the U.S. National Science Foundation's I-Corps model, marked a decisive reinstatement of the innovation dimension that had characterised earlier phases of the partnership, particularly under the UTEN initiative. Eleven research teams from Portugal with strong entrepreneurial ambition participated in a seven-week long bootcamp led by NSF instructors with structured methodologies for customer discovery and market validation. This effort was complemented by the launch of the first edition of the Entrepreneurial Foundations course, led by Mellie Price, which expanded the Program's offer in venture development and commercialisation readiness.

The Program also reinforced its national and international visibility. Participation in Ciência'25 alongside CMU Portugal and MIT Portugal, highlighted the collective contribution of these partnerships to Portugal's scientific and innovation ecosystem and the renewed ambition the new phase. Overseas, the Program organised and hosted a high-level mission to UT Austin, led by the Secretary of State for Science and Innovation, further underscoring political commitment to the Partnership. As part of the agenda structured by the Program, a transatlantic colloquium on electrical grid resilience and energy transition was convened, alongside the closing session of TechLaunch, during which the Portuguese teams presented the outcomes of an intensive customer discovery process conducted in Austin.

As the year drew to a close, FCT and the Ministry of Education, Science, and Innovation announced the appointment of José Manuel Mendonça to chair the new governance structure mandated to oversee the Programs with CMU, MIT, and UT Austin. With the vacancy created by José Manuel Mendonça's new role within the Government's Mission Structure, Rui Oliveira was reconducted as Director of the UT Austin Portugal Program, and Rute André, Full Professor at the University of Aveiro and the Vice-Director of CICECO, appointed to serve alongside him at the Program Board. This leadership configuration combined continuity with renewal, consolidating strategic direction and ensuring robust governance for Phase 4.

9.2 INESCTEC.OCEAN

Coordinator: Diana Viegas

Presentation

INESCTEC.OCEAN stands as Portugal's Centre of Excellence in Ocean Research and Engineering, strategically positioned to lead sustainable technological innovation across marine domains, and contributing to the sustainable and sovereign development of the ocean economy.

In alignment with INESC TEC's institutional strategy, the European Green Deal and the European Ocean Pact, this initiative advances an integrated vision of ocean sustainability that combines scientific excellence, technological innovation, and societal impact.

Through its multidisciplinary capacity in Marine Structures, Marine Robotics, Ocean Energy, and Ocean Data, INESCTEC.OCEAN delivers advanced R&D solutions from the deep sea to earth and space that respond to global challenges and policy priorities such as the EU Mission "Restore Our Ocean and Waters," the Digital Ocean Twin initiative, and the United Nations Decade of Ocean Science for Sustainable Development.

INESCTEC.OCEAN will consolidate its strategic positioning as a trusted partner in shaping the future of sustainable ocean governance and will reinforce its mission to lead globally in sustainable ocean engineering and research, advancing climate resilience, economic growth, and biodiversity preservation while ensuring the responsible use and protection of marine resources. Positioned at the intersection of science, technology, and policy, the Centre catalyses collaboration between academia, industry, and government to deliver transformative solutions for Europe's sustainability agenda. Through a strong culture of knowledge transfer and innovation, INESCTEC.OCEAN expands the frontiers of the blue and green economies - contributing to offshore renewable energy, sustainable aquaculture, shipping, fisheries, and deep-sea resource exploration. Its strategic role within the INESC TEC ecosystem positions it as a driving force in reinforcing EU competitiveness through excellence in ocean research and innovation, addressing global challenges in marine ecosystems and climate adaptation.

These goals are so strategically important for the country (PT) and for the EU that the Centre of Excellence had access to complementary funding from national programs, to be combined with EU project funding devoted to Brainware capacitation and complementary funding dedicated to activities to reinforce the partnerships, improving 4H ecosystem links and re-equipment and re-qualification of existing infrastructures, including support for at least 5 chairs and 20 PhD scholarships. This Centre of Excellence in Ocean Engineering will encompass various elements to effectively advance research, innovation, education, and collaboration in the field. It will contribute to scientific advances in different fields related to Ocean Research and Engineering, establish a higher level of interaction and cooperation between the partners and stakeholders, pursue partnerships, protocols and programs with academia, business associations, incubators/accelerators, funding entities and Venture Capital entities, strengthening the relation with the ecosystem actors, promoting knowledge transfer and bridging the gap between research and industry and leveraging a set of novel technological infrastructures.

Main Achievements in 2025

The year of 2025 has been focused on settling. Within this year there was an effort to established INESCTEC.OCEAN as a Centre of Excellence in OR&E with global recognition and to contribute to the development of the field of Ocean engineering addressing all the key players in the quadruple-helix ecosystem. The INESCTEC.OCEAN is conceived to support effective and self-sustained cutting-edge research, development, innovation, and advanced training activities devoted to technologies to Observe and Operate in the Ocean environment, considering the challenges inherent to the harshness, dimension, and depth of the Portuguese Sea.

During this first year of the initiative, INESCTEC.OCEAN had a close work to the following dimensions:

- Reinforce strategic alignment and close collaboration with High Education Institutions
    - through the negotiation of protocols with academia, namely FEUP and ISEP

- Build stronger knowledge-based and multidisciplinary R&I ecosystems
    - through the definition and operationalisation of 4 main scientific areas (Maritime Infrastructures, Ocean Data, Ocean Energy and Maritime Robotics)
    - through the establishment of MoUs with SINTEF OCEAN, and with other teaming projects and Centre of excellence in marine related areas such as MARBLE in Croatia and CMMI in Cyprus.
- Better align and deliver R&I with industry's needs
    - through the negotiation of corporate research chairs with companies with key activities in Ocean Research and Technology
- Engage in direct dialogue with the public
    - By setting up a Stakeholder forum, already counting with 30+ committed entities, as an international set of key entities that will contribute to the alignment of the Centre of Excellence strategy
- Improve quality, management and usage of our infrastructures
    - through the promotion of protocols with existing infrastructure

10 OFFICES, COMMISSIONS AND ESG

10.1 Compliance Officers

10.1.1 Anti-corruption Compliance Officer

Officer: Ana Maria Mendonça

Presentation

The Regulatory Compliance Programme for the Prevention of Corruption, which is mandatory by law, includes the appointment of an anti-corruption compliance officer responsible for ensuring and overseeing the implementation of the Programme. The role is performed independently, on a permanent basis, and with full decision-making autonomy.

At INESC TEC, the anti-corruption compliance officer is also responsible for the implementation, monitoring, and review of the Risk Prevention Plan (PPR), which forms an integral part of the Programme.

Highlights in 2025

The major activity performed during 2025 was the review of the PPR that was afterwards published in the middle of this year.
For this purpose, an individual meeting with the responsible of each INESC TEC' s Service was held for reviewing the implementation stage of the prevention measures previously included in the PPR. In addition to updating the implementation phase of each prevention measure, during these meetings four new risks, and four corresponding prevention measures, were identified and afterwards added to the Risk Matrix. The new PPR was published in August 2025.

Other activities that were accomplished during 2025 include:

- Elaboration of the final report of PPR execution during 2024.
- Elaboration of the interim evaluation report of the PPR execution during 2025 (for the period between January and September).
- Continuous monitoring of the email address prevencao.corrucao@inesctec.pt for answering questions directed through this means.
- Continuous monitoring of the reporting channel on corruption and breaches of European Union law in certain domains.

10.1.2 Data Protection Officer

Data Protection Officer: Vasco Rosa Dias

Presentation

According to its legal statute the DPO's principal role is to inform, advise about and monitor compliance with data protection law provisions and with the policies of the controller in relation to the protection of personal data, including the assignment of responsibilities, awareness-raising and training of staff involved in processing operations, and the related audits.

Highlights in 2025

Beyond the regular monitoring of personal data related activities, the update and implementation of internal procedures, detailed below, we highlight in 2025:

- Capacity-building and awareness-raising activities were conducted both internally and externally, ensuring a strong presence across diverse academic and non-academic fora.
- Participation in a pioneering Responsible AI course organised by the Portuguese Bar Association, addressing AI implications in justice, law enforcement and beyond, reaching thousands of Portuguese attorneys (September 2025).
- The renewal and enlargement of the cooperation protocol established with ISPUP since 2019 (July 2025).
- Contributions to EU public policies in the field of AI regulation, as in the public consultation on Transparency of GEN AI models Generated Content (sept 2025), and through regular representation at IPQ and JTC21 CEN-CENELEC aiming at the development of AI Act implementing standards.
- Leading role in activities of three Horizon Europe Projects, AEROSUB, CONVERGE and Living SoiLL, and relevant contributions to other projects, approaching areas of convergence between data protection, AI and ethics.

In addition:

- 2025 revealed a new increase and diversification of the activities lead by the DPO's team.
- A large number of data processing and joint controllership agreements was negotiated and implemented, at national, European and international levels.
- Continuous update of the processing activities records. Implementation of new methodology to assess legitimate interest and associated templates.
- Contribution to large scope DPIAs addressing new infrastructures and components of the information system.
- Advise and follow up of Data Protection Impact Assessments performed in the context of R&D projects of INESC TEC and ISPUP, as well as in the wider context of general internal operations.
- Strengthening of the training plan for staff members and researchers, combining existing tools like the online course and open talks with thematic sessions held at R&D centres.
- Issuing of DPO's opinions and recommendations in English version for wider dissemination at INESC TEC community.
- Monitoring and internal auditing activities were strengthened, from websites to public procurement for the acquisition of technology solutions.
- Monitoring and studying new legislation/initiatives (e.g. AI ACT, NIS2, EHDS).

10.2 Internal Commissions and Committees

10.2.1 Conflicts of Interest Management Commission

Chairperson: José Carlos Marques dos Santos

Presentation

INESC TEC has a Conflicts of Interests Management Policy that applies to all core human resources. The Conflicts of Interests Management Commission (CGCI) has the responsibility to ensure compliance throughout the institution, namely by:

a) Assessing the declarations of interests and identifying the conflicts of interests;

b) Agreeing with the collaborator and proposing to the Board the terms of management plans for identified conflicts of interests, to reduce or eliminate those conflicts;

c) Informing the collaborators of INESC TEC about the conclusion of assessment processes and about the terms of possible management plans for identified conflicts of interests;

d) Formulating general recommendations concerning conflicts of interests management.

Highlights in 2025

During 2025, the Conflicts of Interests Management Committee (CGCI), within the scope of its mandate and institutional responsibilities, carried out a broad set of activities, of which the following are particularly noteworthy:

a) Ongoing monitoring of compliance with the Conflicts of Interests Management Policy across the Institution, ensuring its consistent application and adherence to the applicable internal regulations.

b) Providing clarifications in response to several requests submitted by the Board of Directors and by the General Council Ad hoc Committee, in matters related to conflicts of interests.

c) Addressing queries raised by employees concerning the Conflicts of Interests Management process, namely regarding declarative obligations and applicable procedures.

d) Dissemination of relevant guidelines under the Conflicts of Interests Management Policy, both through the dedicated intranet area and via targeted communications sent from the CGCI mailbox.

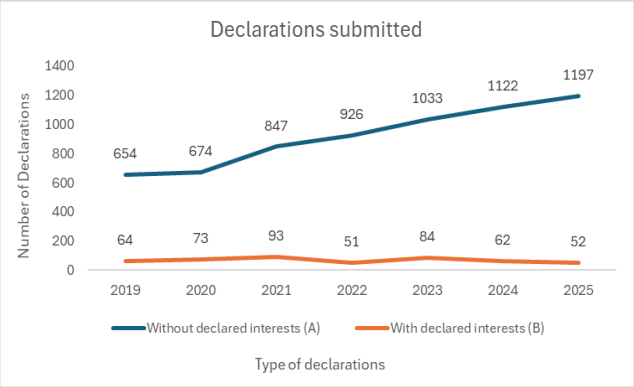
e) Testing the IT platform supporting the Conflicts of Interests Management process, following a substantial technical intervention carried out by the Information Systems and Management Services (SIG) that implied a suspension of the platform operations during approximately five months.

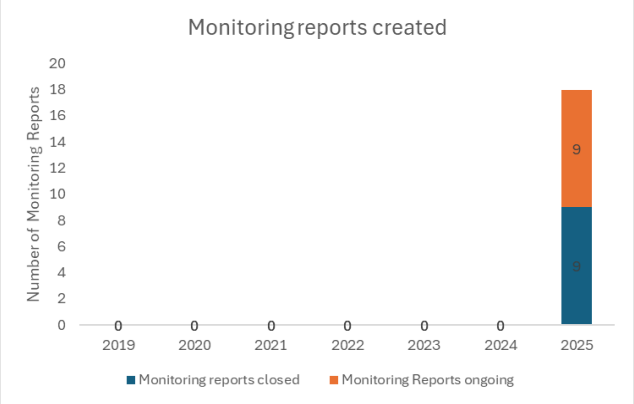
f) Definition of the requirements for adapting the IT platform to incorporate the new procedure concerning the declaration by an INESC TEC employee of the receipt from third parties of any goods with an estimated value of €150 or more, foreseen in the Code of Conduct for the Prevention of Corruption and approved by the INESC TEC General Council as an amendment to the Conflicts of Interests Management Policy. The defined requirements were submitted to SIG for implementation of the necessary modifications to the IT platform.

g) Regular review of submitted Declarations of Interests (DI) and preparation, where justified, of the corresponding Conflicts of Interests Management Plans (PGCI), subsequently submitted to the Board of Directors for potential approval, following the employee's agreement.

h) Supervision of the monitoring process for each Conflict of Interests Management Plan (PGCI), conducted by the designated monitor, to verify the employee's compliance with the measures established therein.

The following figures express the main indicators of the CGCI activity carried out in 2025, in comparison with previous years.





10.2.2 Diversity and Inclusion Commission

Chairperson: Ana Sequeira

Presentation

The INESC TEC Board of Directors established the Commission for Diversity & Inclusion (CDI) in September 2021 to encourage the Institute to implement practices that promote diversity and inclusion (D&I), while developing long-term work in this area. The CDI is currently chaired by Ana Filipa Sequeira and, throughout 2025, was composed of diverse INESC TEC collaborators: Ana Lopes, Tiago Silva, Tiago Gonçalves and Aurora Libânia Teixeira. The CDI's work is supported by the Internal Advisory Group - a representative set of collaborators contributing through brainstorming, discussion, and validation; and the External Advisory Group – a set of key players in the D&I field providing strategic counselling.

Highlights in 2025

In 2025, the CDI focused on awareness-raising, skills development, monitoring the D&I landscape, and promoting initiatives across three priority areas: 1) **Gender Equality;** 2) **Interculturality; and** 3) **Accessibility**.

CDI Internal Advisory Group: The CDI strengthened its Internal Advisory Group, welcomed new contributors through a Call for Expression of Interest, and held a community gathering in July to reinforce engagement with Diversity & Inclusion.

The CDI advanced the monitoring of the implementation of the **Gender Equality Plan** and worked on the updated GEP version for 2026 onwards.

Awareness-raising and competence-building actions: The CDI organised several training actions, events, and communications, and participated in APPDI (*Associação Portuguesa para a Diversidade e Inclusão*) webinars for capacity building and in the Working Group on Organisational Development.

Training actions: Working session "GIA Checklist – How to Incorporate Gender Issues into Research Projects" with Marisa Matias (FPCEUP).

Events:

1) **Eid al-Fitr + Nowruz Celebration:** Celebrated Eid al-Fitr, enriched through collaboration with the Iranian/Persian community by incorporating Nowruz, fostering cultural understanding within INESC TEC.

2)"**Promoting Healthy Work Environments - INESC TEC Barometer":** Session by Professor Tânia Gaspar presenting the "Ecosystems of Healthy Working Environments" (EATS) initiative and launching the INESC TEC Barometer survey to assess professionals' health conditions, lifestyles, and organisational factors influencing well-being and psychosocial risk.

3) **Presentation of the INESC TEC Healthy Workplace Final Report** "INESC TEC Barometer - Promoting Healthy Work Environments" with Tânia Gaspar.

Communications: The CDI supported the publication of the INESC TEC Healthy Workplace Final Report by LABPATS (October); issued a communication marking LGBTQ+ Pride Month (June); and published several articles in BIP.

Other Activities:

1) Community and institutional engagement included participation in the event "Com Asas de Ramalde", organised with Asas de Ramalde – Centro de Dia e Apoio Domiciliário Artur Brás, and in the programme Alianças para a Empregabilidade Inclusiva: U.Porto e Valor T_em Ação, held at the University of Porto Rectory.

2) The CDI contributed to preparing and submitting INESC TEC's participation in the Horizon Europe call HORIZON-WIDERA-2025-06-ERA-04: *Investigating and addressing career barriers faced by underrepresented and marginalised researchers* (IncluERA project proposal).

10.2.3 Technical Committee for Social Responsibility

Chairperson: António Baptista

Team: António Baptista, Carla Sousa, Cristina Barbosa, Diana Guimarães, Lídia Vilas-Boas, Paula Rodrigues, Rita Cardoso.

Presentation

Social Responsibility is "a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis", as defined by the European Commission in 2011. Based on that, in 2019, the Technical Committee for Social Responsibility was created with the goal of working on INESC TEC's philanthropic dimension from an internal point of view, i.e., issues related to the institution itself and its employees; and from an external point of view, i.e., how INESC TEC can support the local community.

Highlights in 2025

- Association to INESC TEC's 40th Aniversary celebration programme, namely with the special spring operation "40 Years, 40 Trees" in joint cooperation with Porto Municipality and Porto Ambiente, where more than 40 INESC TEC's volunteers support the planting of 40 trees in Asprela Park in Porto.
- Organisation of a special operation devoted to Mental Health and Well Being in October to celebrate World Mental Health Day, creating awareness to this important risk for colaborators, families and organisation, to promote good practices for mitigation and early-stage signals detection. Four tematic Webinars were organised with invited experts, with more of 100 collaborators engaged (BIP Magazine).
- The Operation "Tampinhas" reach its end (national-wise) and a replacement operation was elected at INESC TEC by formalising Waste Electronic and Electric (WEE) collection points in the Headquarters.
- Operation "June, Children's Month" was carried out to collect and deliver specific donations for Children Support Association Ajudaris, such as food, books, toys, clothes.
- Donation campaigns of specific INESC TEC's end-of-life equipments, but still usable in second-life low demanding operations, such as small whitegoods, PCs, Laptops and LCDs for solidarity associations which support economic fragile students and researchers.
- INESC TEC was, once again, an official nominator of the Earthshot Prize, a global environmental prize and platform for impact, dedicated to finding and growing solutions that will repair our planet this decade. INESC TEC received four contacts and endorsed one solution under the "fix our climate" Earthshot.
- Promotion of the initiative Levar a Ciência ao IPO do Porto, with focus on Robotics and Spacial Exploration, aiming to share the research carried out at INESC TEC, engaging young children undergoing hospital treatment in STEM domains (BIP Magazine)
- Ongoing participation on the "Escolhas com Futuro" collaborative project, supporting students' community initiatives.
- In scope of the International Volunteer Day activities, a total of 50 INESC TEC volunteers participated in solidarity activities in 6 different institutions: Hospital de S. João, Bebés de S. João, Ajudaris, Animais de Rua, Canil do ICBAS (Porto), Refood (Braga). (BIP Magazine)
- INESC TEC participated in the national-wide initiative (440 entities involved) for ´25 Christmas Season campaign "O melhor presente é estar presente" for road safety and accident prevention.

10.2.4 Ethics Committee

Chairperson: Pedro Guedes de Oliveira

Presentation

The INESC TEC Ethics Committee (EC) was appointed by the Board of INESC TEC in 2022 and has since been chaired by Pedro Guedes de Oliveira, Professor Emeritus at the University of Porto and Chairman Emeritus of INESC TEC. The Committee includes Susana Magalhães, who holds a PhD in Bioethics and is Coordinator of the Unit for Responsible Conduct in Research at I3S and a Professor at Fernando Pessoa University; Vasco Rosa Dias, Data Protection Officer at INESC TEC and ISPUP; and Alípio Jorge, a Professor at the Faculty of Sciences of the University of Porto and a researcher at INESC TEC. Cristina Ribeiro, a retired Professor at the Faculty of Engineering, served on the Ethics Committee until October.

The Ethics Committee is responsible for promoting standards of integrity, honesty and responsibility in all activities undertaken by INESC TEC members, particularly in their research endeavours, through adherence to the institution's Code of Ethics.

Highlights in 2025

Submissions

In 2025, a significant number of new projects were submitted to the EC. The ethics questionnaires submitted online, where required, form the basis for the EC's assessment of projects and allow approval to be granted where the responses meet expectations and no specific concerns are identified.

To date, no project has received a negative evaluation from the EC. Nevertheless, in several instances, a dialogue has been established with PIs, in order to clarify uncertainties or to improve supporting documentation. This occurs most frequently in projects involving personal data, where close interaction with the Data Protection Office is essential and is facilitated by the presence of the INESC TEC Data Protection Officer (DPO) on the EC.

Whenever a formal ethics assessment of a project is required, a specific form must be submitted by the PI and the EC then formulates its judgement. In 2025, the number of such cases was small and arose in response either to requests from funding agencies or to requirements linked to the submission of papers concerning project results.

Infrastructure

In 2025, updates to position papers and legislation have been added to the EC website, and changes have been made to the IT platform through which PIs submit their projects, providing a clearer and more user-friendly interface. However, its performance and completeness still require further improvement.

Other activities

In 2025, the INESC TEC Open Talks on Ethics in Research and Defence concluded with three further conferences:

- On 25 February, Álvaro Vasconcelos, founder of the Demos Forum and holder of the José Bonifácio Chair at the University of São Paulo in 2023 and 2024, delivered a talk entitled "Humanism without Borders".
- On 8 May, Afonso Seixas-Nunes, priest and Assistant Professor of Law at Saint Louis University, USA, delivered a talk entitled "Proportionality in War: Room for AI Systems or Imminent Disaster?".
- On 23 September, Michael Teutsch, AI Strategist and Lead at HENSOLDT, delivered a talk entitled "Ethics in Action: Challenges and Responsibilities of Military AI in Surveillance and Reconnaissance".

The three conferences attracted a large audience, particularly among INESC TEC researchers, and generated meaningful discussions between speakers and attendees.

Final Remarks

Once again, we extend our gratitude to INESC TEC researchers for their thoughtful and responsible conduct, which has made our work both manageable and rewarding.

10.3 Other Institutional Initiatives

10.3.1 Foresight and Public Policy Office

Head: Joana Almodovar

Presentation

The Foresight and Public Policy Office is INESC TEC's dedicated structure for strengthening the institute's contribution to public policy and strategic reflection on emerging societal, technological and economic challenges. In line with the scope defined for 2025, the Office works at the interface between research, innovation and policymaking, supporting evidence-based engagement with public authorities and other stakeholders, promoting the dissemination of policy-relevant knowledge, fostering dialogue across regional, national and European levels, and contributing to foresight-oriented reflection within the institute. In 2025, this mission was pursued through policy engagement, stakeholder interaction, support to institutional positioning, and the growing integration of public-facing platforms and communication instruments that reinforce INESC TEC's role as a science-policy interface.

Highlights in 2025

In 2025, the Foresight and Public Policy Office evolved towards a more structured and visible role in INESC TEC's policy engagement and public dialogue. This process was marked by the hiring and start of functions of the first Head of the Office, reinforcing its institutional consolidation and creating stronger conditions for continuity, coordination and external projection. More broadly, 2025 represented a relevant step in the transition from the initial Public Policy Office logic towards a broader Foresight and Public Policy Office, with a clearer role in institutional positioning, policy dialogue, strategic communication and public reflection. This trajectory is consistent with the scope defined in the 2025 plan, namely the strengthening of policy impact and engagement, stakeholder interaction, collaboration with INESC Brussels HUB, and the integration of public-facing platforms such as the Autumn Forum and Science & Society Magazine.

At European level, the Office contributed to policy processes and strategic debate through several complementary channels. These included INESC TEC's contribution to the European Commission consultation on the strategy for start-ups and scale-ups, where the institute advanced proposals on proof-of-concept funding, regulatory simplification, access to investment, specialised acceleration and the creation of European consortia for deep-tech entrepreneurship. The Office also helped frame and support institutional contributions to the European debate on research and technology infrastructures, including the publication of a position paper advocating a more integrated approach to governance, lifecycle funding, interoperability, access mechanisms and territorial cohesion. In addition, INESC TEC participated in a European Commission expert workshop on the future Blueprint for academic spin-offs, contributing reflections on licensing, revenue sharing, institutional equity participation, knowledge-transfer architectures and ecosystem maturity.

This European dimension was further reinforced through articulation with INESC Brussels HUB in major discussions on research and innovation policy, competitiveness and transformative technologies. The Winter Meeting 2025, held in Porto, brought together more than 200 participants and focused on governance and funding of research and technology infrastructures, combining high-level policy dialogue with practical discussion on needs, gaps and opportunities for RTOs. The Summer Meeting 2025, held in Brussels, focused on "Strategic Autonomy & Dual-Use R&I" and addressed issues such as FP10, the coherence between European strategic instruments, the role of research-performing organisations in dual-use R&I, foresight and knowledge security. A particularly relevant moment took place at the high-level European Commission event on Artificial Intelligence and Energy, where João Claro was the only representative of a research organisation invited to address both the role of AI in Europe's digital and energy transition and the conditions for more sustainable AI systems.

The Office's activity also included support to direct institutional dialogue with public authorities through high-level visits to INESC TEC. These included, in particular, the visit by the Secretary of State for Fisheries and the Sea, accompanied by the Director-General for Maritime Policy, which enabled discussion of public policy priorities for the Sea, the Blue Economy and the role of INESCTEC.OCEAN and related infrastructures. In parallel, the Office contributed to broadening INESC TEC's public-facing reflection on science, innovation and policy through the 10th Autumn Forum, dedicated to the theme Being human in the Age of AI, and through selected INESC TECWatch columns connecting technological developments with wider questions of innovation, competitiveness and public policy.

10.3.2 INESC Brussels Hub

Head: Ricardo Miguéis

Presentation

In 2025, its fifth year of operation and a defining one for European R&I policy, the INESC Brussels HUB consolidated its role as a strategic engine for INESC TEC's European positioning. As the European Commission entered the design phase of Framework Programme 10 (FP10), the European Competitiveness Fund (ECF), and a new Multiannual Financial Framework (MFF), the HUB strongly supported INESC TEC's positioning as an active contributor to policy design, institutional governance, and the shaping of Europe's strategic autonomy agenda.

This evolution is directly aligned with the INESC TEC Strategic Plan 2030. Through sustained policy analysis, thought leadership via The Insider podcast and other EU-level communication and intelligence products, flagship convening events, the negotiation of a Memorandum of Understanding with the JRC, and deepened EARTO engagement, the HUB enabled INESC TEC to operate at the intersection of research, industry, and European R&I policy. Notably, this work was sustained by a single person during the first half of 2025, before the team expanded to four members by December, delivering more than 900 professional engagements across the year.

Highlights in 2025

In 2025, the HUB reinforced INESC TEC's strategic representation and engagement in the European R&I ecosystem through participation in more than 30 high-level events, active involvement across six EARTO working groups and task forces, regular collaboration with Science|Business, the negotiation of the JRC-INESC Memorandum of Understanding, formal contributions to six EU public consultations, and participation in initiatives linked to research and innovation in Ukraine. Particularly relevant was the analytical work on the FP10-ECF nexus, including legal architecture, Treaty basis and governance implications, which strengthened INESC TEC's contribution to ongoing European policy debates.

The HUB also organised and supported a set of flagship events that reinforced INESC TEC's institutional visibility and thought leadership. The Winter Meeting 2025, held in Porto, gathered over 200 participants and focused on governance and funding of research and technology infrastructures, combining high-level policy dialogue with a practical workshop feeding into RITIFI recommendations. The Summer Meeting 2025, held in Brussels and organised with Science|Business and PlanAPP, addressed "Strategic Autonomy & Dual-Use R&I", including FP10, EDF2, EDIS coherence, foresight and knowledge security. In addition, the HUB co-hosted a Widening Roundtable in Brussels and organised a webinar on FP10 and the ECF, helping position INESC early in the evolving legislative debate.

The strategic projects and proposals portfolio also expanded in 2025, spanning RTI governance, regional innovation ecosystems, science diplomacy, AI, education and dual-use/security themes. Approved and ongoing initiatives such as RITIFI, ERA FABRIC, RIFF, AI SECRETT and FUND-RI, alongside proposals in preparation, reinforced the HUB's role in connecting intelligence, positioning and project development. Throughout the year, the HUB further strengthened INESC TEC's institutional credibility through high-level meetings in Brussels, expert evaluations, more than 30 bilateral networking meetings across the Brussels ecosystem, the drafting of an operational charter, adoption of Asana as a project management platform, and the formalisation of the Sensing & Seising framework to structure intelligence flow between the HUB and institute leadership.

Overall, by combining sustained policy analysis, proactive institutional positioning, a growing project portfolio, and The Insider as a communication and thought-leadership platform, the HUB consolidated its evolution from representation office to strategic engine, enabling INESC TEC to anticipate European opportunities and contribute to the design of the frameworks that shape them.

10.3.3 Research Student Office

Officer: Sara Brandão

Presentation

The Research Student Office is responsible for the development and coordination of strategic initiatives, strengthening INESC TEC's capacity on advanced training. Operating at a systemic level, it defines and implements the conditions that enable excellence throughout students' research journeys, in alignment with the institute's long-term strategic objectives.

Working in close articulation with the Board of Directors, the Office contributes to strategic definition, institutional coherence and evidence-based decision-making concerning a community that plays a central role in INESC TEC's scientific output and innovation capacity.

Through an integrated and multi-dimensional approach, it strengthens supervision practices, institutional partnerships, monitoring mechanisms and visibility, consolidating INESC TEC's position as an international reference in doctoral education and as a distinctive actor in advance training. By engaging key internal and external stakeholders, it ensures that the institutional conditions are in place for research students to achieve excellence and generate high-impact scientific outcomes.

Highlights in 2025

Following an initial phase of implementation, 2025 marked a foundational year focused on establishing the institutional conditions and mechanisms required for high-quality doctoral education. While priority was placed on structural development, some key initiatives were implemented, generating tangible results and reinforcing institutional capacity.

Student Experience and Talent Attraction

In 2025, priority was given to strengthening the institutional foundations that shape the research student experience and reinforce INESC TEC's talent attraction capacity. Structural progress was achieved through the formal consolidation of the PhD Representatives Committee, establishing a stable platform for student representation, dialogue and institutional alignment. In parallel, initial steps were taken to enhance internal communication channels and clarify INESC TEC's value proposition for research students, contributing to more coherent engagement and improved attraction and retention conditions.

Alongside these structural developments, key initiatives delivered measurable impact. The INESC TEC Summer Internships Programme was consolidated as a structured talent attraction instrument, offering 121 internships and consistently receiving high satisfaction ratings. Approximately one third of participants continued research collaborations with INESC TEC, demonstrating its effectiveness as a strategic pipeline for future doctoral recruitment.

A pilot Expression of Interest call for prospective PhD candidates was also launched, introducing a more structured and expedited recruitment mechanism. While still in refinement, this initiative marked an important step towards strengthening early identification and attraction of high-potential doctoral candidates.

Supervision, Partnerships and Funding Sustainability

Initial steps were taken to strengthen the institutional foundations supporting supervision quality and collaborative doctoral models. Participation in a workshop on high-quality supervision initiated internal reflection on shared practices and opened space for dialogue towards a more structured culture of doctoral supervision. In parallel, exploratory engagement with academic institutions and industry partners advanced the discussion of collaborative doctoral frameworks, including the development of intellectual property templates to support clearer and more structured company involvement.

Alongside these structural developments, targeted support to major national funding calls - particularly the FCT PhD Scholarships - reinforced INESC TEC's competitiveness and funding performance. Active guidance to supervisors and candidates, combined with the promotion of doctoral opportunities in non-

academic environments, contributed to strengthening collaborative doctoral pathways and securing over one million euros in annual funding. This represents a critical instrument for financial sustainability and for expanding high-quality doctoral opportunities within the institution.

Monitoring, Governance and Student Progression

A central priority in 2025 was the establishment of the analytical and monitoring foundations required for informed governance of doctoral education. Initial progress was made in consolidating dispersed student-related data and defining the key indicators necessary to support systematic oversight of academic progression, research output and funding outcomes. The development of a PhD Students Dashboard marked an important step towards strengthening institutional visibility over doctoral activities and enabling more structured decision-making.

In parallel, the mapping of the PhD Lifecycle at INESC TEC was initiated as a strategic exercise to clarify expectations, responsibilities and critical milestones across the doctoral journey. This work laid the groundwork for a shared institutional understanding that will support future quality assurance mechanisms and student progression frameworks.

The design of a Research Experience Survey, informed by benchmarking against international practices, further reinforced this monitoring framework. By preparing the ground for the regular assessment of student satisfaction, supervision quality and institutional support mechanisms, the initiative strengthened INESC TEC's capacity to anticipate challenges, guide continuous improvement and align doctoral education with its long-term strategic objectives.

Institutional Positioning and Recognition

In 2025, preparatory steps were taken to inform the future strategic positioning of INESC TEC's doctoral environment. Participation in international forums on doctoral education enabled benchmarking against leading institutions and informed the strategic refinement of INESC TEC's value proposition in advanced training. These engagements contributed to reinforcing its positioning as a competitive and internationally embedded research institution.

In coordination with other INESC TEC structures, a strategic contribution was also made to the design of a Scientific Outreach framework. This included mapping existing initiatives, benchmarking national and European best practices, and engaging with key stakeholders to identify needs and opportunities for collaboration. To respond to growing demand for school engagement an Open Week initiative was designed and implemented, and two pilot collaboration protocols were established with secondary schools. These preparatory efforts contribute to the foundation for the development of a coherent outreach strategy aimed at engaging schools and strategic partners, supporting researchers' voluntary initiatives, and creating sustainable and impactful activities.

10.3.4 Project Office

Team: Lígia Silva, Luís Carneiro and Mário Jorge Leitão

Presentation

The Project Office includes two main activities:

- One activity relates to the operation of a Project Management Office (PMO) at INESC TEC. PMO responsibilities include defining processes, standards, and best practices for project management; designing and developing IT and methodological tools; training project managers; managing a portfolio of projects; and monitoring and reporting on project performance. The PMO serves as a centralised support unit, aiming to ensure efficiency and effectiveness in the management of projects, both transversal and R&D centres projects; promoting stakeholders' satisfaction; compliance with funding requirements; maximising the project results, and alignment with the institute strategic goals.
- The other activity is related to the development and provision of tools to support the management and control of projects and the overall activity at INESC TEC (analytical accounting), enhancing the capabilities of the institutional ERP and other applications, especially in the areas of annual planning (initial and updates), budget control and management of compensation schemes for the participation of academic staff and grant holders in projects.

Highlights in 2025

The following are the PMO main highlights in 2025:

- Development of a set of support tools, including a Project Management Manual and a set of templates (project charter, kick-off meeting presentations, meeting minutes, risk management, and project benefits);
- Collection of specific requirements from the Centres and Services and development of the Institute Maturity Assessment report;
- Development of a specific IT support for project management that was integrated into IRIS (INESC TEC Research Information System). The tool supports the definition and monitoring of the project baseline (including Workpackages and Deliverables), Risks and Benefits management. A one page dashboard allows an easy sharing of the project status among the team members, the Centre coordinators and support Services;
- Development of a page in the Intranet to share the PMO methodologies and tools;
- Several training activities were implemented to support the project managers capacitation in the selected methodologies, best practices and tools;
- A pilot with projects selected from different Centres was started. The adoption of the defined processes and tools, with the necessary adaptations to the reality of each project, will be gradually enlarged to more projects;

For the general project support the following are the main highlights in 2025:

- Adaptation of existing tools and develop new ones to interact with the new ERP that started its operation in January 2025, enhancing the analytical accounting processes of the institution, aiming at timely and accurate production of planning and execution indicators;
- Adaptation of the existing human resources and analytical accounting processes to the requirements raised by internal users and by new financial models recently adopted in National and European R&D programmes.

10.3.5 Entrepreneurship and Spin-offs Office

Team: Alexandra Xavier, Daniel Vasconcelos, Alípio Torre and Vasco Rosa Dias

Presentation

The Entrepreneurship and Spin-offs Office (ESO) supports the transformation of research outcomes developed at INESC TEC into entrepreneurial initiatives and spin-off companies. The ESO works closely with researchers and the Technology Transfer Office to identify opportunities, structure entrepreneurial projects, and connect them with relevant partners, investors, and support programmes.

ESO activities aim to nurture a culture of innovation and entrepreneurship within the research community, while providing practical support across the early stages of venture development, from initial idea exploration to the formal approval and incorporation of spin-offs. The ESO also fosters collaboration with industry, investors, and other research and technology organisations to strengthen the entrepreneurial ecosystem around INESC TEC.

Highlights in 2025

2025 marked the first year of activity of the Entrepreneurship and Spin-offs Office and focused on establishing the initial basis for a more structured institutional approach to entrepreneurship and spin-off support at INESC TEC. In this context, the Office combined community-building initiatives, early-stage venture support, follow-up of active spin-offs, and external ecosystem engagement.

To strengthen entrepreneurial culture and build a community around research-based innovation, the Office organised four Entrepreneurship Talks, featuring founders from Seedsight, Amparo, LTPlabs and AddVolt. These events attracted an average of 20 participants per session and created opportunities for researchers to interact with experienced entrepreneurs and gain insight into the challenges of building technology-based companies.

The ESO also launched Office Hours, creating an accessible entry point for researchers interested in exploring entrepreneurial pathways. During 2025, this initiative supported 20 first-contact cases, offering early guidance on venture development, market exploration, and spin-off creation. Through these activities, seven entrepreneurial projects started to be actively developed during the year and remain ongoing by year-end.

In parallel, two new spin-offs were approved, with one, KEPSoft CIC, formally incorporated in 2025. The Office also ensured follow-up and support to active spin-offs, including Ubirider, iLoF, inSignals Neurotech, UGR and Seedsight, helping founders navigate growth, partnerships and investment opportunities. Notably, Seedsight successfully raised €1.8M in funding in 2025, representing an important milestone for the INESC TEC entrepreneurial ecosystem.

The ESO further strengthened its engagement with external partners by exploring collaboration with VITO and connecting with national venture capital firms such as Armilar Venture Partners and Faber, reinforcing access to investment and entrepreneurship programmes. Overall, 2025 laid the foundations for a more systematic and visible entrepreneurship-support capability within INESC TEC, to be further consolidated and scaled in the following year.

10.4 Environmental, Social and Governance

ESG Reporting: Sustainability commitment and highlights

This section presents INESC TEC's ESG performance for 2025, organised around environmental, social and governance dimensions, drawing on confirmed institutional data and documented initiatives, framed by GRI standards.

Material ESG Themes

INESC TEC's most material ESG themes in 2025 can be organised around six institutional priorities:

- Energy transition, renewable integration and energy communities.
- Sustainable mobility, smart infrastructure and decarbonisation of operations and logistics.
- Circularity, resource efficiency and environmentally responsible behaviours.
- Healthy work environments, mental health, work-life balance and employee well-being.
- Diversity, inclusion, gender-equality implementation and community engagement.
- Integrity in research and technology transfer, including conflict-of-interest management and transparent institutional processes.

ESG Initiatives: Sustainability as three-fold responsible practices

Environmental Dimension

INESC TEC's environmental performance in 2025 combined quantified operational data with new infrastructure investments. Key indicators and initiatives are shown in Table 10.1 and Table 10.2.

Table 10.1 - Operational environmental initiatives, 2025

Initiative	Confirmed evidence and relevance
Headquarters mobility and energy test bed	At the Asprela headquarters, a CPES-led test bed combined solar self-generation and smart EV charging. From February to September 2025, solar production reached 15.3 MWh and free EV charging reached 17.3 MWh. Approximately 88% of charging was ensured by endogenous renewable generation, corresponding to more than 108,000 km travelled in electric mobility and 14.6 tonnes of CO2 avoided versus conventional vehicles.
Recycling performance	INESC TEC received the Nespresso Professional Recycling Certificate again in 2025, reporting 378 kg of capsules recycled during 2024. Collection increased 78% from 2023 to 2024, reinforcing waste segregation practices and complementing the use of personal mugs in shared kitchen areas.
40 Years, 40 Trees initiative	In partnership with Porto City Council, the institution launched a 40-tree planting initiative to celebrate its anniversary while promoting carbon capture and a more sustainable future.
National Sustainability Day	Institutional communication connected sustainability with electric mobility, tree planting, solid-waste segregation and energy-efficiency measures in buildings, reinforcing behavioural engagement at community level.
International Day against Climate Change	The Technical Committee for Social Responsibility promoted awareness of climate action through practical guidance on energy and water efficiency, renewable energy, reuse, recycling, repair and sustainable mobility choices.

Table 10.2 - Environmental performance indicators, 2023–2025

Indicator	2023	2024	2025	Note
Electricity consumption (kWh)	632,112	730,450	782,587	+23.8% vs 2023
of which data centre A+B (kWh)	n.d.	~201,000 (annualised)	236,174	+17% vs 2024; 30% of total
of which EV charging (kWh)	~13,500	~25,000	~88,000	3 BEV+4 PHEV → 14 BEV+6 PHEV
Gas consumption (kWh eq.)	~64,000	68,786	79,601	-
Water consumption (m^3)	n.d.	1,982	1,949	−2%
Solar self-generation (MWh)	n.d.	~18	21	+17.9 MWh new install. committed
CO_2 gross - electricity (tCO_2)	~80	~93	~99	Factor: 0.127 kg/kWh (PT grid)
CO_2 gross - gas (tCO_2)	~13	~14	~16	Factor: 0.202 kg/kWh
CO_2 total gross (tCO_2)	~93	~107	~116	-
CO_2 avoided - EV programme (tCO_2)	-	n.d.	−22 (annualised)	vs petrol 1400cc; 108,000 km
CO_2 net (tCO_2)	~93	~107	~94	≈ flat vs 2023 baseline
2030 target (−30% from 2023)	-	-	~the same as 2023 despite the ~24% increase in electricity consumption	−30% vs 2023 baseline: 93 tCO_2 × 0.70 = ~65 tCO_2

Electricity consumption at the Asprela headquarters reached 782,587 kWh in 2025 (2024: 730,450 kWh; 2023: 632,112 kWh), an increase of 23.8% over three years - virtually identical to the 23.5% growth in total headcount over the same period (1,525 in 2023 to 1,884 in 2025). The two main drivers were the data centre infrastructure (236,174 kWh, 30% of the building total) and the vehicle charging programme, which grew from seven plug-in vehicles in 2023 (3 BEV + 4 PHEV) to twelve in 2024 (7 BEV + 5 PHEV); in 2025 the institutional fleet stabilised at ten plug-in vehicles, complemented by personal vehicles from employees participating in a charging pilot - brought in on non-remote days, producing a natural weekly rotation - averaging a further ten sessions per day. The combined average of approximately twenty daily sessions (14 BEV + 6 PHEV) implies charging consumption of approximately 88,000 kWh in 2025, up from ~25,000 kWh in 2024 and ~13,500 kWh in 2023. Together these two loads grew by approximately 98 MWh year-on-year while total building consumption grew by only 52 MWh, meaning base-building consumption fell by approximately 46 MWh (-9%) as a result of lighting upgrades, revised HVAC set points, equipment replacement and the decision to close the building between midnight and 07:00. The EV programme transfers individual Scope 3 commuting emissions to institutional Scope 2; at Portugal's grid carbon factor (0.127 kg CO_2/kWh), this produced approximately 14.6 tCO_2 avoided between February and September 2025, with 88% of charging covered by on-site solar. Gas consumption was 79,601 kWh equivalent (2024: 68,786 kWh).

In 2025, several energy infrastructure investments were initiated. A centralised management system using proprietary INESC TEC algorithms - designed to optimise HVAC, lighting and EV charging against local solar production and grid carbon intensity - was piloted on two building floors but was not yet in full operation at year-end. A booking algorithm giving priority to BEV for journeys under 200 km increased BEV reservations by approximately 20% relative to 2023. A 11.9 kWp photovoltaic installation was committed for Building A, expected to raise total annual self-generation to approximately 39 MWh. A heat pump was installed in parallel with the existing gas boiler and ice-bank chiller, supplying Buildings A and B; its effects on gas consumption will be visible from 2026. A freecooling system for the data centre, designed to recover heat for building heating, was also initiated but not yet operational at year-end.

Water consumption reached 1,949 m^3 in 2025 (2024: 1,982 m^3, −2%), following installation of sensors and timers. Circular economy practices were reinforced through waste management plans, awareness campaigns on waste separation, and a dedicated electronic waste campaign.

As an Official Nominator of the Earthshot Prize, INESC TEC launched an internal call for innovative sustainability solutions from its research community.

Through the Enterprise Europe Network (EEN), INESC TEC is active in the Sustainability and Green Innovation thematic groups, supporting companies in their transition to more sustainable business models.

Social dimension

The social dimension covers workforce development, inclusion, well-being and community engagement, drawing on HR data and documented institutional initiatives.

Workforce profile and people development

Table 10.3 - Social dimension indicators

Indicator	Value	Note
Total headcount	1,884 (Core HR: 1,218)	Growth of 23.5% since 2023 (1,525); Core HR excludes external students and researchers
Research team	945 (583 researchers + 407 PhD students; -5 double-counted)	+11% vs 2023 (852); researchers with PhD: 410 (70% of researchers)
Management, Administrative and Technical Staff	144	+18% vs 2023 (122)
Grant Holders	504	Largest single group within Core HR; +25% vs 2023 (402)
Trainees	59	+490% vs 2023 (10); reflects scale-up of the trainee programme
Training	20 average annual hours per contracted collaborator	Total: 8,420 h (contracted); 10,402 h including all links
Nationality diversity	90.6% Portugal; 9.4% foreign	Visiting Researchers: 35 in 2025 (up from 11 in 2024)
Age diversity	23% below 30; 61% 30–50; 16% above 50	Balanced profile with strong early-career representation

Well-being, work conditions, inclusion and community

Table 10.4 - Well-being institutional actions

Theme	Evidence of institutional action
Well-being and work-life balance	Reported initiatives include protocols with psychology offices, training on physical and psychological health, a support line, hybrid work arrangements and flexible schedules.
Healthy Work Environments Barometer	The Diversity and Inclusion Commission promoted the presentation of results from the INESC TEC Barometer on healthy work environments, developed with Professor Tânia Gaspar and based on the EATS survey on health conditions, lifestyles and the organisational role in promoting well-being.
Mental health	The Technical Committee for Social Responsibility marked World Mental Health Day and organised a cycle of talks and sharing sessions dedicated to mental health and well-being, together with resource signposting such as helplines, podcasts and information portals.

Theme	Evidence of institutional action
Diversity and Inclusion	The Diversity and Inclusion Commission remained active in 2025, with members drawn from different functions and a remit that includes events, initiatives and collaboration in the development, monitoring and implementation of the Gender Equality Plan.
Volunteering and solidarity	Institutional calls for volunteering and solidarity campaigns mobilised the community around social contribution. Goods collected in the Children's Day solidarity campaign were delivered to partner institutions supporting children and young people.

INESC TEC promoted inclusive working conditions through listening mechanisms such as the Diversity and Inclusion Survey, flexible working practices, and mental health initiatives including mindfulness, a meditation room and World Mental Health Day activities. Healthcare coverage was extended through the Multicare Vitality Programme and renegotiated to include expanded outpatient and childbirth benefits.

Equal opportunities remained a priority, with continued implementation of the Gender Equality Plan, safeguarding of gender pay equity in performance appraisal, and support for interculturality and inclusion. The institution hired persons with disabilities, promoted universal accessibility, and launched a trainee programme providing students with hands-on experience in research teams.

Salary increases were implemented at the start of 2025 with particular attention to lower income brackets. Occupational health and safety training was strengthened, and the institution participated in the EU-OSHA European Campaign "Healthy Workplaces 2023–2025". Training beyond legal requirements was supported and individual development aligned with institutional goals.

Through the EEN Women Entrepreneurship Thematic Group, INESC TEC connects women entrepreneurs with business and innovation support, access to foreign markets, and local network cooperation.

Governance dimension

INESC TEC's governance framework in 2025 combined integrity mechanisms, strategic alignment and public accountability, as summarised in Table 10.5.

Table 10.5 - INESC TEC's Governance Mechanisms

Governance mechanism	Institutional significance
Conflict of Interest Management Policy and Platform	INESC TEC reaffirmed in 2025 that it maintains a Policy for the Management of Conflicts of Interest as a key instrument to safeguard the independence and integrity of research and technology-transfer activities. The dedicated commission evaluates declarations of interests and proposes conflict-management plans for approval where needed.
Reactivation of the platform	The 2025 reactivation and improvement of the platform indicates maintenance of the governance system rather than a purely symbolic policy.
Diversity and Inclusion Commission	The commission acts as a governance mechanism for inclusion-related actions, while also supporting the implementation and monitoring of the Gender Equality Plan.
Technical Committee for Social Responsibility	The committee serves as an organisational anchor for sustainability awareness, mental health actions, volunteering and broader social-responsibility mobilisation.

National Sustainability Day (25 September) was marked with engagement activities across the institution, reinforcing awareness of the environmental, economic and social dimensions of sustainability and the SDG commitments embedded in INESC TEC's Strategic Plan 2023–2030.

The Strategic Plan 2023–2030 frames research and innovation around the long-term preservation of social, economic and environmental systems, with active alignment to the SDGs and engagement in national and international sustainability networks and forums.

On responsible conduct, INESC TEC introduced training on the Corruption Prevention and Whistleblower Protection Regime, a Code of Conduct for harassment prevention, and a Compliance Programme for the Prevention of Corruption. Research activities adhered to the Code of Ethics; the institution also extended social responsibility principles to its supply chain and promoted awareness of digital ethics including algorithmic bias.

Priorities for the next reporting cycle

In line with Omnibus2 implementation and standards simplification, INESC TEC remains committed to showcasing its ESG practices and evolving into KPIs. The report will evolve into a comprehensive impact-performance framework, enabling not just transparency, but effective monitoring and cross-cutting sustainability management. The four main priorities for the next period are:

- Consolidate institution-wide environmental metrics, especially electricity, gas, water, waste and emissions, with clear organisational boundaries.
- Refine gender and leadership datasets to ensure consistency between totals and category-level distributions.
- Expand governance reporting to include ethics, procurement, data protection, risk management and training.
- Move from initiative reporting to target-based reporting, enlarging the KPIs and year-on-year comparability, translating the current narrative into an institutional ESG dashboard aligned with recognised frameworks such as GRI, a process that has already started.
- Include a Risk Management section in the ESG report.

The ESG area is still under improvement, and a full ESG reporting will highlight ongoing efforts and provide a structured foundation for tracking INESC TEC's contributions to a more sustainable planet.

[2] https://ec.europa.eu/commission/presscorner/detail/en/qanda_25_615

11SUPPORT SERVICES

11.1 LEGAL SUPPORT SERVICE

Manager: Rita Barros

Employees
1 Men
4 Women

Presentation

The Legal Support function plays a fundamental role in furthering INESC TEC's mission of fostering scientific research, innovation, and technology transfer. The service is committed to protecting the institution's interests by ensuring strict adherence to applicable international, European, and national legal and regulatory frameworks. It promotes best practices in key areas such as human resources management, institutional partnerships, contractual matters, public procurement procedures, and data protection compliance. The team is dedicated to delivering tailored and pragmatic legal solutions, as well as providing comprehensive support and guidance in response to legal queries, always aiming to offer the most suitable and effective advice for each specific situation.

Highlights in 2025

The service continued to deliver critical support to the Institution's activities across a wide range of areas, including research and development contracting, public procurement procedures, intellectual property matters, and labour-related issues. It ensured alignment with the applicable legal and regulatory frameworks while closely tracking developments in International and European law within these fields. In this context, the Legal Support Service sustained a highly demanding workload, further expanding the breadth of its intervention. Its principal contributions comprised:

- Providing assistance to the Human Resources Service in addressing the complexities stemming from the Institution's diverse contractual models and their specific legal particularities.
- Ensuring representation within the Ethics Committee, thereby promoting coherence in the handling of multifaceted matters and safeguarding compliance with legal and regulatory obligations.
- Supporting the Management Control Service, particularly in relation to the legal framework applicable to project expenditures and engagement with funding entities.
- Overseeing an increasing volume of contractual arrangements, both within the framework of funded projects and through direct agreements established with national and international companies and organisations.
- Expanding the drafting and review of Non-Disclosure Agreements (NDAs) with national and international entities, facilitating preliminary discussions for prospective collaborations or service provision.
- Delivering legal support in the negotiation and preparation of licensing agreements in close coordination with TTO and participating in a dedicated Task Force created to supervise strategic projects involving intellectual property concerns.
- Preparing and negotiating Consortium Agreements for the European projects PVSMILE, ATLAS, SOLAR-MOVE, OVERWATCH, SYSTEMEU, BATTLEVERSE and AGROBOOST. Additionally, contractual negotiations were conducted for numerous other European initiatives in which INESC TEC participated as a partner.
- Providing legal assistance to the International Relations Service, including the negotiation and drafting of Memoranda of Understanding (MoUs) and the issuance of legal opinions concerning residence permits and visa procedures.
- Delivering comprehensive legal counsel to support informed decision-making at executive level, encompassing strategic evaluations of institutional activities, governance issues, and compliance

with evolving regulatory requirements. This included drafting strategies and agreements, advising on risk management approaches, and contributing to the legal supervision of administrative processes.

- Ensuring guidance and oversight to secure compliance with the General Data Protection Regulation (GDPR) and related national legislation. This involved the early identification and monitoring of research initiatives with potential data protection implications, the development of standard templates, and the negotiation and drafting of data-sharing and data-processing agreements.
- Monitoring and implementing compliance measures arising from Regulation (EU) 2024/1689 (Artificial Intelligence Act), with a view to anticipating its impact on research, development, and technology transfer activities. This involved the progressive integration of AI-related clauses into a wide range of contractual instruments. The service ensured the identification of potential high-risk AI applications, the allocation of responsibilities between parties, and the adoption of safeguards aligned with transparency, accountability, and risk-management obligations.
- Acting both as a contracting authority and as an economic operator in public procurement procedures. As a contracting authority, the service played a central role in supporting the implementation of major infrastructure projects, ensuring adherence to procurement rules and procedural requirements. As a tenderer, it managed the legal intricacies associated with the preparation of competitive proposals, compliance with procedural formalities, and the protection of the Institution's interests in competitive bidding processes.
- Increase in participation in public procurement procedures in the capacity of contracting entity. Submission of tenders in procedures launched by major contracting authorities, such as INIAV (National Institute for Agrarian and Veterinary Research), UTAD (University of Trás-os-Montes and Alto Douro), Infraestruturas de Portugal, Intermunicipal Communities, E-Redes, the Portuguese Army, the Directorate-General for Territory, among others.

11.2 ACCOUNTING AND FINANCE SERVICE

Manager: Libânia Caetano and Paula Faria

Employees
1 Men
9 Women

Presentation

The Finance and Accounting Service plays a crucial role in managing INESC TEC's financial operations. It is responsible for overseeing all accounting activities, ensuring compliance with fiscal obligations, and maintaining a stable cash flow to meet financial commitments.

Beyond its core financial functions, the service acts as a key intermediary between INESC TEC and external entities, operating in alignment with the Board's strategic guidelines. It also manages essential administrative tasks, including procurement, travel processes, insurance policies, and fixed assets, ensuring efficient financial and operational management across the institute

Highlights in 2025

The Finance and Accounting Service is committed to improving efficiency and implementing innovative financial solutions for the INESC TEC community, in alignment with the INESC TEC Strategic Plan 2023-2030. In 2025, the service successfully focused on key initiatives that strengthened financial sustainability, optimised processes, and promoted environmental responsibility.

1. Improve quality, management and usage of our infrastructure

- Increased the efficiency of Fixed Assets Management, ensuring more accurate control and allocation of resources.
- Implemented the optimised Requisitions/Procurement Workflow, improving the accuracy and reliability of commitments-related information and enhancing the availability and quality of cumulative data used for public procurement.
- Completed the implementation and rollout of the new ERP system, enabling improved financial, administrative and operational integration across the institution.

2. Strengthen the sustainability and resilience of our economic model

- Reinforced the continuous improvement of internal activities and practices, contributing to greater operational robustness.
- Successfully managed the financial processes for large-scale conferences, ensuring efficient coordination of payments and receipts and supporting smooth and cost-effective event execution.

3. Promote and contribute to environmental sustainability

- Consolidated the digital archive process, supporting paper reduction and more sustainable document-management practices.

4. Improve attraction and retention of world-class talent

- Provided financial guidance and resources to support the integration of new transnational hires, contributing to a smoother and more informed onboarding experience.

5. Increase our international networking, leadership and competitiveness

- Developed efficient systems for managing international payments, tax compliance and currency exchange, supporting global collaborations.
- **Expand the diversity of our community**
- Enhanced support for international initiatives through a stronger understanding of tax frameworks and compliance requirements.

By focusing on these strategic initiatives, the Accounting and Finance Service contributed to greater financial resilience, process efficiency, and sustainable practices, ensuring continued support for INESC TEC's long-term growth and success.

11.3 MANAGEMENT CONTROL SERVICE

Manager: Bárbara Maia and Vanda Ferreira

Employees
3 Men
11 Women

Presentation

The Management Control service is responsible for coordinating and executing the activities inherent to budgetary planning and control, and to produce, coordinate and disseminate management information in order to ensure that all resources are obtained and used effectively and efficiently to fulfil the purposes of the institution. The service is also responsible for continuous reporting to funding agencies of financial reports and the reimbursement of expenses, monitoring funded projects for compliance with funding agencies terms and conditions by working closely with researchers and providing training whenever necessary.

Highlights in 2025

During 2025, the service supported the administrative and financial management of 217 funded projects, having submitted 211 financial reports to the respective funding entities, which represents more than 28 million euros of expenses.

In addition to funded projects, the service monitored 134 projects providing direct services to companies, which in 2025 represented 3.8 million euros.

Among European funded projects, 100 were funded by Horizon 2020 and Horizon Europe EU framework programs, 11 of which were coordinated by INESC TEC. The service also reported 8 projects funded by other European Programs, such as INTERREG. The expenses reported throughout the year accounted for 7 million euros.

Regarding national projects, the largest volume of expenditure submitted concerns the PRR projects, representing 11.7 million euros, included in financial reports, followed by FCT projects, with 1 million euros of expense.

There were also a set of large-scale strategic projects such as FCT's Multiannual funding, large infrastructures, and funding for Technology and Innovation Centres managed by ANI, that required a huge effort from the service (37 financial reports), representing more than 7 million euros of reported expense.

About internal control, during 2025 the service was heavily involved in completing the implementation of the SAP ERP system, fixing bugs, integrating it with other internal systems, and training users.

11.4 HUMAN RESOURCES SERVICE

Manager: Margarida Gonçalves and Susana Rodrigues

Employees
2 Men
7 Women

Presentation

The Human Resources Service coordinates and executes all activities related to human capital management, ensuring the effective administration of HR processes and the strategic development and implementation of people-related policies. It plays a key role in aligning workforce strategy with organisational objectives by attracting, developing, and retaining talent while fostering a positive and inclusive work environment.

Highlights in 2025

The HR Service was restructured into two main areas: Development & Culture and Operations & Compliance, bringing together complementary functions and dedicated teams to strengthen both strategic action and operational effectiveness.

Activities in Development & Culture:

- **Talent attraction and people experience:** development of an institutional job offer template to improve the consistency and attractiveness of proposals to candidates; participation in Project Geração (IM)Provável to strengthen visibility among younger generations; structuring, onboarding and management of over one hundred summer interns; and improvement of employee information and experience through guidance on remote work, benefits, tax and caregiver-worker status, health insurance, digital employee cards, attendance registration and the reformulation of the LinkedIn group Connect.
- **Career development:** conduct of strategic work with the Board on the review and refinement of the job descriptions and competency framework policy, alongside the reformulation of the Performance Appraisal Policy and the definition of its functional, technical, and governance requirements.
- **Organisational transformation and European alignment**: preparatory work for the implementation of the HR Excellence in Research Award; participation in the Mutual Learning Exercise with EU Member States and the European Commission on research careers; co-founding of the HR4EXCELLENCE Portugal Community of Practice; and coordination of the preparation of the REALISE CSA proposal, a large-scale European initiative on research careers and implementation support.
- **Training and health and well-being:** implementation of the 2025 training plan based on diagnosed needs and stakeholder input, including 10 internal courses delivered by centres and services to 159 employees; creation of a dedicated Health and Well-being area; assessment of workplace health and safety conditions; and development of new initiatives and partnerships, including with FEUP in the area of neurodiversity.

Activities in Operations & Compliance:

- **Compensation, benefits and internationalisation:** monitoring and administrative management of TechVisa processes, international recruitment and payroll procedures, including cross-border hiring, as well as the establishment of new partnerships and protocols through the corporate benefits platform.
- **Legal and financial compliance:** preparation and implementation of the Remuneration Gap Assessment Plan in compliance with ACT requirements; HR support to strategic programmes such as FCT Tenure and OCEAN-FCT; development of an HR Guide covering contractual typologies and project cost-allocation rules; administrative management of FCT PhD grants under INESC TEC's role as contracting entity; and reinforcement of procedural compliance in Calls for Applications.
- **Systems, analytics and process improvement:** introduction of monitoring mechanisms for recruitment platforms, automation and simplification of contractual and fellowship-related workflows, and improvement of administrative communication and transparency, including scholarship-complement communication and the review of curricular internship procedures.

11.5 MANAGEMENT SUPPORT SERVICE

Manager: Isabel Macedo

Employees
1 Men
2 Women

Presentation

The Management Support Service coordinates institutional information management and oversees the planning and reporting of INESC TEC's activities. It supports the Board of Directors in advancing strategic initiatives and facilitates decision-making at the General Council level. With a cross-cutting role, it drives process improvement, ensures institutional analytics, and enhances research support through FAIR data stewardship, open data and open access engagement, and research assessment.

Highlights in 2025

In addition to its core operational activities, the Service's key highlights, aligned with the INESC TEC Strategic Plan 2023-2030, are outlined below:

- Raise the contribution and visibility of our research
    - Conclusion of INESC TEC's application to the FCT R&D Units Evaluation process, ensuring coordinated alignment across the final stages of the assessment exercise.
    - Development and structuring of domain-level performance indicators for INESC TEC's 2025 Scientific Advisory Board visit, reinforcing capacity for analytical monitoring and research assessment.
    - Advancement of Open Science practices through the leadership and execution of the FAIRWay project, in consortium with CIIMAR and BIOPOLIS and funded by FCT, contributing to the establishment of a national network for research data management and openness in Portugal, aligned with FAIR principles.
    - Elaboration and formal proposal of the INESC TEC Open Data Policy, establishing a framework for FAIR-aligned research data management and sharing, with a consultation phase scheduled for 2026.
    - Strengthening of research data management support through the preparation and review of Data Management Plans for European-funded projects, the design and implementation of a certified Research Data Management course within INESC TEC's internal training framework, and the launch of a pilot study at CTM to assess data management practices and support future institutional scaling.
    - Reinforcement of institutional engagement in Open Science and Research Data Management through participation in national and international fora, the operationalisation of the Open Science task force, and actions to support awareness, diagnosis and evidence-based institutional improvement.
    - Continued support to access, use and dissemination of scientific information and organisational knowledge, including mediation and analysis regarding B-On usage and the establishment of an institutional protocol with NAU.
- Strengthen the distinctive aspects of our institutional model
    - Coordination of an internal task force to ensure INESC TEC's compliance with FCT's new decentralised doctoral grant model, including the establishment of documentation, reporting, and monitoring procedures under INESC TEC's role as Contracting Institution.
    - Launch of Phase I of the "Simplifying Work @ INESC TEC" initiative, engaging support and information systems services in the collaborative redesign of internal processes to enhance agility and user-centricity, while preparing a future institution-wide phase.

- Design of a transformation roadmap for the HR Service, combining diagnostic analysis and process architecture definition to enhance operational autonomy, support leadership transition, and lay the foundations for more scalable and streamlined HR management.
- Executive support to organisational transitions across Offices and Centres, reinforcing institutional alignment and governance effectiveness, together with a contribution to the design and structuring of INESC TEC's new website, ensuring coherent information architecture and institutional consistency.
- Strengthening of R&D management capacity through the development and refinement of analytics and performance indicators aligned with strategic priorities, including Diversity and Inclusion, Scientific Production, Research Students, and International Partnerships, alongside the optimisation of quarterly performance reporting.
- Systematic reinforcement of data governance through cross-platform quality assessment, encompassing the curation of theses, dissertations and publications databases, the full roll-out of the entities database as a central framework for data coherence and integration, and coordinated information collection to support strategic initiatives.
- Management and facilitation of INESC TEC's accession to the associations Linux Foundation for Energy, OCG, SUSTEMARE and YEAR, and its withdrawal from EBRAINS and EIT Manufacturing.

11.6 SECRETARIAL COORDINATION

Managers: Ana Isabel Oliveira and Grasiela Almeida

Employees
20 Women

Presentation

The Secretarial team is responsible for effectively executing the tasks required for the development of the activities of the Board of Directors, Research Centres and Services they support, in accordance with INESC TEC´s internal rules and processes.

This team, composed of 20 employees, develops their work directly under the responsibility of a coordinator within a structure, centre or service, being also coordinated by one of the above-mentioned managers: Ana Isabel Oliveira manages the team of Executive Assistants of the Board of Directors and Grasiela Almeida manages the team of Assistants that support the Research Centres and Services.

Highlights in 2025

Apart from the regular operational activities mentioned above, the main highlights in 2024 were:

- **Team Expansion & Training**: Recruitment and training of three new Assistants - two for CPES (Centre for Power and Energy Systems) and TEC4, and one Executive Assistant for the Board of Directors;
- **Administrative Support Reorganisation**: Restructuring part of the administrative support team by service type (Organisation & Management, Business Development, and Technical Support) to optimise resources and enhance efficiency;
- **Executive Support Enhancement**: Strengthening support for the Board of Directors, organisational structures, associative bodies, and intervention areas, contributing to more effective decision-making and strategic alignment;
- **Upskilling & Digital Transformation**: Delivery of an Advanced Microsoft Excel Training for the Secretariat Team to enhance data-driven decision-making and digital proficiency, supporting INESC TEC's focus on digital transformation and internal capacity building;
- **Onboarding Process Development**: Collaboration in the development of a new onboarding framework for interns, reinforcing the institute's commitment to attracting and integrating young talent;
- **HR Policy Contribution**: Participation in the R&S GTE - Recruitment and Selection Working Group, contributing to the development of the "Guidelines for the New R&S Policy";
- **Vendor & Contract Oversight**: Systematic monitoring of contracts with travel agencies, catering providers, and printing services, ensuring operational efficiency and cost-effectiveness, supporting the institute's goal of sustainable management;
- **Institutional Knowledge Management**: Ongoing maintenance and optimisation of CRM as the institutional contacts database, reinforcing the institute's focus on structured knowledge management and digital tools.

11.7 FUNDING OPPORTUNITIES OFFICE

Manager: Marta Barbas

Employees
1 Men
1 Women

Presentation

The Funding Opportunities Office aims to identify relevant funding opportunities to support INESC TEC's Research, Development and Innovation activities, aligned with the Institute's mission and objectives. This service will also support and supervise the development and submission of proposals to various funding programmes, in collaboration with the R&D Centres and the other Business Development Services.

Highlights in 2025

Among the activities developed, we shall highlight, for its relevance, the maintenance and update of the Funding Opportunities pages on the Intranet, which are available to everyone to access information regarding the different Funding Programmes (funding rates, rules of participation, call calendars, etc.). the workshops on National and European funding organised for the centres, and finally the support provided for the high volume of submissions to FCT Programmes, Portugal 2030 and Horizon Europe. We also maintain several meetings with Horizon Europe National Contact Points and principal researchers of coordinated proposals. We also hold information sessions for the most competitive national calls.

Some facts and figures related to the submitted proposals monitored by the service:

- Business R&D - Co-promoted Operations P2030/N2030: 18 proposals
- Business R&D&I - Co-promoted Operations P2030 - Small Mobilising Agendas: 17 proposals
- Intellectual and Industrial Property Protection Projects P2030: 1 proposal
- Collective Action Support System Projects (P2030/N2030): 3 proposals
- Funding for Regional Platforms for Smart Specialisation N2030: 3 proposals
- R&D Projects Health Research La Caixa Foundation/FCT: 2 proposals
- Exploratory Projects in All Scientific Domains FCT: 44 proposals
- Exploratory Projects in cooperation with American Universities (CMU, MIT, UTA) FCT: 12 proposals
- Exploratory Projects Health+Science FCT: 4 projects
- DigitalTwins4SmartTerritories (DT4ST) Call FCT/ARTE: 7 proposals
- IC&DT Projects Data Science and Artificial Intelligence in Public Administration FCT: 9 proposals
- FCT R&D Projects - International Partnerships: 16 proposals
- BIP Proof Call UP: 7 proposals
- European Tenders: 2 proposals
- INTERREG Programmes: 6 proposals
- HORIZON Europe: 153 proposals
- Digital Europe Programme: 2 proposals
- European Defence Fund: 15 proposals
- ERASMUS 2027: 5 proposals
- LIFE Programme: 2 proposals
- Asylum, Migration and Integration Fund (AMIF): 1 Proposal
- Interregional Innovation Investments Instrument (I3): 1 proposal
- EU4Health Programme (EU4H) l: 1 proposal
- EIT Water: 1 proposal
- EIT Food: 2 proposals
- Cascade Funding: 6 proposals.

11.8 TECHNOLOGY LICENSING OFFICE

Manager: Daniel Marques de Vasconcelos

Employees
3 Men
2 Women

Presentation

The INESC TEC Technology Transfer Office (TTO) seeks to maximise the societal and economic impact of the institution's research and development outcomes through structured technology scouting, intellectual property (IP) strategy, and knowledge valorisation. In 2025, after 13 years of operating as the Technology Licensing Office (Serviço de Apoio ao Licenciamento), the Office adopted the TTO designation to align with international practice and to reflect INESC TEC's growing role in the European knowledge transfer ecosystem. This transition formalises a broader remit beyond licensing, covering multiple transfer routes and proactive collaboration with research teams to maximise impact.

Highlights in 2025

2025 was a year of strong upstream performance in scouting and IP generation. Approximately 70 new R&D results were mapped, the highest level in the last six years, and the number of first priority patent applications increased sharply to 19 new priority filings. This translated into continued growth of INESC TEC's active patent families to 56, a historical maximum, consolidating the institution's patent footprint.
The TTO also strengthened its external positioning and network, with the recognition of INESC TEC's impact through the 3rd Prize at the EARTO Innovation Awards (Impact Expected category), marking the third consecutive distinction for INESC TEC in this competition. In parallel, new agreements and connections were established with relevant US and European universities and R&D organisations to formalise joint IP efforts and collaboration around global challenges.

The Office also restarted structured training activities, with two IP training sessions and one open-source software workshop, totalling 66 trainees, and contributed to PhD training at FEUP through the creation of the optional course Innovation Management and Knowledge Transfer. It also supported strategic governance milestones, including the first transfer of an INESC TEC open-source project to the Linux Foundation and institutional work on open-source software guidelines and onboarding approaches.

In the area of IP valorisation, a particularly relevant outcome was the establishment of the KEPsoft CIC spin-off, which joined forces with three European universities to improve kidney transplantation.

In 2025, the TTO successfully achieved all the planned objectives, which align with the Strategic Objectives of the INESC TEC Strategic Plan 2023-2030, as further explained:

1. Strategic IP management framework. Scouting of PRR projects was reinforced through 21 follow-up meetings, resulting in 19 Technology Disclosure Forms, while simplified disclosure approaches, portfolio database improvements, AI-assisted workflows, and 19 priority filings and 6 PCT filings contributed to a leaner and more internationally oriented IP management model. Patent-cost sustainability also improved through fundraising and resource mobilisation, with approximately €179k secured to support patent costs and further submissions under evaluation.

2. Active industry engagement. The Office pursued multiple meetings and outreach actions, including dozens of network contacts for need and commercial validation, seven submissions to specialised brokers, and participation in strategic events such as Carnot in Paris via TECPartnerships. While engagement increased, commercial outcomes remained uneven, pointing to the need to further professionalise repeatable deal-flow mechanisms and express licensing pathways.

3. Capacity building and ecosystem development. The Office strengthened training and awareness actions, advanced the structuring of a success-stories initiative with 14 cases prepared, and reinforced its international networking through the TTO Circle and other European fora such as ASTP and LES.

11.9 INTERNATIONAL RELATIONS OFFICE

Manager: Andreia Passos

Employees
1 Men
4 Women

Presentation

The International Relations Service (SRI) continues to play a strategic role in advancing INESC TEC's global positioning. In 2025, its mission remained focused on supporting the Board of Directors and the R&D Centres in maximising international partnerships, funding opportunities, and institutional visibility.

The Service advises on high-level collaborations aligned with institutional strategic priorities, supports researchers' international mobility, and strengthens organisational capacity for sustained global engagement. It also monitors external geopolitical and regulatory developments that may influence cooperation with foreign partners and contributes to communicating the impact of international activities across the organisation. Following the renewal of FCT's Partnerships with a select group of world-class U.S. universities at the end of 2024, the SRI continues to host the Portuguese office of the UT Austin Portugal Program, a responsibility it has held since 2018. This continued mandate reflects the Service's recognised performance and the trust of the Partnership's sponsor, FCT, and the Leadership of the Program at UT Austin.

Nevertheless, the Service continues to operate within meaningful structural constraints, particularly regarding team size and organisational positioning. Addressing these challenges will be essential to ensure continued responsiveness to INESC TEC's expanding international ambitions.

Highlights in 2025

In 2025, the Service defined a set of objectives aligned with INESC TEC's 2023-2030 Strategic Plan and contributed, within its remit, to advancing the institution's long-term internationalisation goals.

Under the objective of increasing the international embeddedness of INESC TEC's community, the Service launched the fourth edition of the INESC TEC International Visiting Researcher Programme (IIVRP), now established as a flagship institutional mobility scheme. Simultaneously, the SRI continued to manage the third edition and monitor the outcomes of previous cohorts to inform evidence-based decisions regarding future funding calls. Between 2022 and 2025, the number of applications increased by nearly 500%, rising from 19 to 107, reflecting the Programme's growing international visibility and attractiveness.

Recognising the importance of international exchanges for career development and scientific excellence, the Service produced a preliminary report on promoting outbound mobility in support of INESC TEC's long-term strategy. The report, which has been shared with the Board of Directors, is expected to contribute to embedding outbound mobility more firmly into the institution's research culture. In 2025, the SRI also helped refine the blueprint of potential mobility programmes with partners in India and Brazil, with the view to rolling them out in due course. In parallel, the SRI continued to raise awareness of funding instruments (e.g.: Fulbright, LaCaixa, ERASMUS) supporting both incoming and outgoing mobility through tailored communication and direct support to researchers. The Service also managed internal calls for third-party visiting researcher programmes, most notably the NII's International Internship Programme.

The Service maintained close contact with the two 2024 NIAR-INESC TEC research consortia, monitoring progress and supporting the resolution of non-technical implementation challenges related to collaboration across different geographies with distinct regulatory or cultural frameworks. Lessons learned from this experience informed the design and launch of a second joint call with the Taiwanese partner in the final quarter of the year, further strengthening the partnership. Support for overseas internationalisation continued, with particular emphasis on Asia through the service's participation in the Operations Committee of CENTRA. This position provides the SRI with privileged access to research centres, institutes, and laboratories in Asia and North America engaged in cyberinfrastructure and related applications. With Latin America, the service helped shaped the EU–LAC Supercomputing Network for AI that secured INESC TEC's participation in an initiative under the EU's Global Gateway Strategy that will enhance the use of existing HPC resources in LAC countries and promote links with Europe's advanced supercomputing ecosystem, which includes Portugal's supercomputer, Deucalion.

Also, following the renewal of FCT's agreement with UT Austin for a fourth funding cycle, the SRI continued to host the Program's Portuguese office. Throughout 2025, but mainly in the first quarter of the year, the service supported the Leadership in discussions with the sponsor, FCT, and the Ministry of Education, Science and Innovation, to fine-tune the Program's core instruments and governance model. This work was instrumental in ensuring a smooth transition to a more ambitious phase and in rolling out several activities and events agreed upon for 2025.

During the ramp-up of the Phase 4 of the UT Austin Portugal Program, the SRI was tasked with organising the INESC Brussels Winter Meeting 2025, lending its experience and know-how in high-level event planning and management to support the Winter Meeting owner, the INESC Brussels office. This was a particularly demanding assignment given the short preparation timeframe.

Alongside its operational responsibilities, the Service contributed to intercultural development through the organisation of a dedicated training activity for the INESC TEC community, the International Negotiation training programme. It also proactively supported institutional continuous improvement by producing working documents and strategic reflections in areas related to internationalisation and internal processes impacting the onboarding of foreign staff or the collection of relevant data for indicator development. These included proposals for a revised dashboard of internationalisation indicators and a report on INESC TEC's foreign talent landscape, outlining challenges, opportunities, and strategic considerations.

Since 2021, the SRI has played a leading role in raising awareness of research security and integrity in international scientific cooperation among the INESC TEC community. Building on previous work, including the draft Safe Cooperation Research Guidelines submitted to the Board of Directors in 2024, the Service continued in 2025 to contribute input towards the development of an integrated institutional research security framework. It was regularly consulted to advise on international collaborative opportunities that raised research security considerations.

Overall, 2025 consolidated SRI's strategic positioning within INESC TEC's international agenda, while also highlighting the need for reinforced structural support to sustain and scale its growing responsibilities.

11.10 COMMUNICATION SERVICE

Managers: Joana Desport Coelho and Sofia Maciel

Employees
2 Men
8 Women

Presentation

The Communication Service (SCOM) works closely with the Board of Directors to define and implement INESC TEC's communication strategy, strengthening its reputation and positioning it as a leading R&D institution. Its activities cover internal communication, promoting knowledge sharing and engagement within the community, and external communication, enhancing the institution's visibility and supporting the dissemination of scientific and innovation activities. SCOM operates across the following key areas: science communication content production, public relations, digital marketing, design and multimedia, translation, and leadership and support in R&D project communication.

Highlights in 2025

2025 was marked by the commemoration of INESC TEC's 40th anniversary, a milestone that influenced both external and internal communication activities throughout the year. It was also a year of significant progress in the development of the new institutional website, scheduled for launch in 2026, and of stronger public positioning of INESC TEC researchers in societal debates connected to their scientific domains, including current topics such as the Iberian Peninsula blackout.

External Communication:

- **Strategic visibility and media intelligence:** 2025 marked a structural shift in INESC TEC's external positioning with the subscription of the Meltwater media intelligence platform, which enabled systematic monitoring of media coverage, social media conversations, thematic trends and geographic reach. In its first year of implementation and combined with the distribution of 12 international press releases, Meltwater strengthened the management of INESC TEC's reputation and strategic positioning by turning dispersed references into actionable intelligence.
- **Content and thought leadership:** the Science & Society Magazine, podcast and videocast, Science Bits podcast, Spotlight, and INESC TEC Watch continued to reinforce INESC TEC's science communication capability. Special relevance should be given to INESC TECWatch, with 10 editions published in 2025, including the one on the Iberian blackout, which recorded more than 2,700 views and reinforced the institution's positioning on current affairs through expert analysis.
- **Public relations and digital channels:** national and international press relations continued to contribute strongly to INESC TEC's visibility, with 855 news items identified in national media and 12 international press releases distributed to segmented audiences. Digital channels also maintained growth, with the website surpassing 63,000 visits, the BIP Newsletter increasing its subscriber base and visits, and LinkedIn exceeding 31,600 followers, while Bluesky and TikTok were launched, and the LinkedIn group "Connect" was reactivated.
- **Events, outreach and brand implementation:** SCOM supported 104 external events in 2025. The INESC TEC Autumn Forum, integrated into the 40th anniversary celebrations, gathered more than 500 participants at Casa da Música, the highest attendance to date, and the first INESC TEC Open Week welcomed 120 students. In parallel, 2025 marked the full operational implementation of the institutional rebranding, with the dissemination of templates and materials through the Intranet, ensuring greater coherence and consistency across organisational units and projects.
- **Design and multimedia:** SCOM contributed to 141 video productions in 2025, supporting institutional campaigns, event promotion, videocasts, awareness initiatives and anniversary-related content. Emphasis should be given to integrated campaigns combining video, digital marketing and media outreach, including the International Day of Women and Girls in Science, National Scientific Culture Day, the Autumn Forum, INESC TEC Open Week, Café de Ciência, and the new edition of the Science & Society Magazine.

External Communication:

- **Internal events and institutional culture:** within the framework of the 40th anniversary celebrations, SCOM developed a commemorative programme that strengthened participation, a sense of belonging, and institutional culture. Key moments included the “40 Years, 40 Cakes” celebration, INESC TEC on the Move, the Strategic Meeting, and the Season Party, all of which registered strong participation and reinforced opportunities for collective reflection, recognition, and celebration.
- **Community engagement and recognition:** through internal communication channels such as Mattermost and email, SCOM continued to share regular updates on the life of the institution, helping colleagues stay informed about key developments, recognise internal talent and celebrate achievements. More than 350 posts were published on Mattermost throughout the year, generating more than 1,500 interactions and reactions.
- **Feedback and strategic development:** a survey on internal communication activities was conducted for the first time in recent years, marking an important step towards a more strategic approach in this area. With 129 responses, the results provided a structured basis for future improvement and confirmed a positive assessment of both the activities developed and the usefulness of the information shared.

11.11 NETWORKS AND COMMUNICATIONS SERVICE

Manager: Fernando Sousa

Employees
3 Men

Presentation

The Networks and Communications Service is responsible for the operation and maintenance of INESC TEC's voice and data infrastructures, the implementation of network-based services, and for providing users the respective support.

Besides daily operation and support in the utilisation of resources (e.g., network access, telephony, hybrid events, printing, etc.), permanent activities of the service include the continuous monitoring of the infrastructure, namely to allow for corrective and preventive measures. Strategic modernisation and improvements (concerning e.g. performance, scale, security) is also conducted, for example in the provisioning of data centre resources, network equipment, videoconferencing solutions, etc.

Highlights in 2025

- We took over the management of the institution's mobile communications with MEO.
- Implementation of the new NETDB tool.
- Implementation of network monitoring tools, Suricata and ntopNG.
- Network cabling was installed for fixed network points and Wi-Fi access points were set up in the Tribe greenhouse.
- Completion of the SUBMERSE project with the IP link between Sines and INESC TEC.
- Beta testers of the new FCCN DNS Firewall platform.
- Protocol signed for the use of the iaEDU platform with FCCN.
- Subscription to FCCN's IOC as a Service. Implementation of indicators of compromise (IOCs) on the firewall and network monitoring systems.
- Installation, in all meeting rooms, of a videoconferencing system, consisting of a 65" TV and Logitech equipment.
- Telephone upgrades for all administrative staff and management.
- Reinforced security of the VoIP service.
- Replacement of CA and Services printers
- Deployment of fibre to FEUP (FEUP technical room), 3rd floor of Building I and room I304:
    - Installation of switches in Buildings I and J
    - Installation of Wi-Fi access points on CPES lab (building J) and on building I304
    - Installation of VoIP phones in the rooms
    - Direct connection of the following rooms:
        - ✓ CPES lab- Building J
        - ✓ CBER I303C
        - ✓ CTM I304
- Restructuring of the CPES lab network, installation of new switches, and creation of project support networks:
    - Installation of new switches for the workbenches
    - Deployment of fiber from the laboratory to the data centre

- PTP link to the virtualisation infrastructure
- Installation of fiber patch in the laboratory to connect the workbench switch to the core switch
- Planning and connection of 170 Shelly devices from the electrical panels to the network infrastructure
- Creation of a support network for Shelly devices and automation equipment
- the Heat pump connection to the network

- Finalisation of the electrical panel change project of data centre
  - Creation of a new electrical panel to support the data centre, with redundancy between transformer substations
  - Upgrade of the data centre electrical panels from single-phase to three-phase
  - Upgrade of the UPS protection system, replacing a parallel configuration of 30 kVA UPS units with a single 80 kVA three-phase UPS

11.12 MANAGEMENT INFORMATION SYSTEMS SERVICE

Managers: Fábio Alves and João Miguel Silva

Employees
7 Men

Presentation

The Management Information Systems Service is responsible for coordinating and executing all activities related to the development and maintenance of INESC TEC's management information system.

The primary goal of the service is to provide technology-based solutions to support a wide range of processes, helping the organisation to work more efficiently.

The key systems under SIG's supervision include the Human Resources system, the Intranet (which supports automated workflow processes and facilitates internal institutional communication), the INESC TEC Research Information System (IRIS), the Institutional Repository, the official website, uONEConnect (a project management platform for European projects) and CRM. In addition, SIG offers support to various departments in their interactions with the financial SAP system.

Highlights in 2025

In 2025, the Management Information Systems Service focused on consolidating the new ERP, strengthening systems integration, and reengineering critical processes, while simultaneously reinforcing management support and strategic decision-making tools.

Its activities were structured around three main pillars:

- Application consolidation and integration
- Process digitalisation and simplification.
- Strengthening management and governance tools

Consolidation of the New ERP and Systems Integration

The functional centralisation process within the new ERP continued, with a direct impact on operational efficiency.

Main results:

- Expansion of the middleware integration layer with the new website, ensuring greater interoperability and data consistency.
- Strengthening of integrations between the ERP, financial systems, HR, and project management platforms.
- Migration of requisition and invoicing processes to the ERP, simplifying financial workflows and increasing traceability.

Overall impact:

- Reduction of redundancies and manual tasks.
- Increased control and auditability.
- Improved quality and consistency of institutional information.

Reengineering of the Project Proposal Process

The project proposal submission and management process was redesigned, focusing on:

- Improving user experience.
- Integration with entity databases.
- Standardisation of approval workflows.

Results:

- Reduction of administrative errors;
- Greater efficiency in the submission cycle.

- Improved integration between scientific and administrative areas.

Reengineering of HR Processes

- Improved user experience.
- Enhanced interoperability between HR processes and the HR database.

Conflict of Interest

The Management Information Systems Service provided technical support for the implementation of the new monitoring process for Conflict of Interest Management Plans, ensuring its full digital operationalisation.

Mechanisms were developed to enable structured registration, monitoring, and updating plans, ensuring traceability and differentiated access according to user profiles. The solution was designed with a strong focus on information confidentiality and compliance with institutional governance and transparency requirements.

This intervention strengthened the robustness of the process, increased its reliability, and reduced manual procedures, contributing to more effective and consistent institutional monitoring.

Evolution of the uONECOnnect Platform

The uONEConnect platform was consolidated as a central tool for project monitoring and governance.

The following were implemented:

- New executive summary offering project reviewers a single-view dashboard for tracking project execution.
- New project risks and benefits reporting tools.

Impact:

- Integrated and cross-cutting view of the institutional portfolio.
- Improved support for strategic decision-making.
- Reduced reliance on manual reporting and parallel tools.

Project management tools

As part of the new PMO work group, a new set of tools has been developed to enhance and support project activity execution across the project life cycle.

The solution's key features encompass full WBS registration, automated semaphore alerts for schedule deviations, integrated communication tools, risk and benefits management, and financial oversight - enabling a 360-degree view and complete control over project execution.

Conclusion

The year 2025 was marked by strong technological and organisational consolidation, with particular emphasis on:

- Progressive centralisation within the ERP.
- Consistent integration between systems.
- Reengineering of critical processes.
- Strengthening of the uONEConnect platform as a governance instrument.
- A step forward in project management control, aligned with the PMO work group's strategic vision
- Digitalisation of key institutional processes.

The Management Information Systems Service reinforced its role as a strategic partner to the scientific, administrative, and financial areas, contributing to greater efficiency, integration, and digital maturity across the organisation.

11.13 SYSTEM ADMINISTRATION SERVICE

Manager: Jaime Dias

Employees
5 Men

Presentation

The System Administration Service (SAS) manages servers, computer systems, common applications and services, and provides support to end users, administrative staff and research and development teams. SAS is responsible for the operation of core digital platforms, including virtualisation, storage, collaboration and identity services.

SAS plays a central role in INESC TEC's cybersecurity posture at the systems and identity level, contributing to security hardening, security monitoring and incident handling in coordination with the Security Operations Centre (SOC), the Computer Security Incident Response Team (CSIRT) and other IT services. SAS also collaborates with the Data Protection Officer in the evaluation and implementation of technical measures that support compliance with the GDPR.

Highlights in 2025

In addition to its core operational activities, the Service's key highlights, aligned with the INESC TEC Strategic Plan 2023-2030, are outlined below.

Identity and email consolidation (strategic milestone)

In 2025, SAS implemented a hybrid identity architecture establishing a single authoritative account per user, synchronised between Active Directory and Microsoft Entra ID, and deployed a Hybrid Exchange configuration consolidating approximately 2,000 mailboxes into Microsoft 365.

The migration was executed under full production coexistence, ensuring service continuity and zero data loss, and was concluded by year-end.

Impact:

- Unified identity and access governance
- Foundation for Multi-Factor Authentication (MFA) enforcement
- Enablement of Intune-based device management
- Simplified lifecycle management
- Strengthened backup and cybersecurity controls

Endpoint security modernisation

The endpoint protection platform was replaced, transitioning to CrowdStrike (EDR), aligning endpoint protection with industry-standard EDR practices and strengthening SOC integration.

Impact:

- Enhanced real-time threat detection and behavioural analytics
- Improved integration with SOC monitoring processes
- Stronger incident response capabilities
- Increased visibility across endpoints

Automated endpoint deployment

A new automated Windows deployment service was implemented, integrated with the M365 tenant (M65) and managed through Microsoft Intune.

Impact:

- Standardised device configuration
- Centralised policy enforcement and patch management
- Reduced manual provisioning
- Improved compliance and endpoint control

MLOps platform (Pilot)
Several MLOps platforms were evaluated during 2025. A solution was selected and deployed in pilot mode with selected Centres, providing workflow orchestration, scalable execution and integration with INESC TEC's S3-compatible storage for data and artifact management.

Impact: improved reproducibility of ML workflows, more efficient use of computing resources, and establishment of a structured foundation for institutional AI development. Institutional rollout is expected in H1 2026.

Computing infrastructure (CCloud)
Three new high-performance servers were integrated into the CCloud cluster in 2025, adding 576 CPU cores and 4.5 TB of RAM, with dual-port 100 GbE connectivity per node.

Additionally, a GPU-accelerated server was acquired in 2025 (to be delivered in Q1 2026), equipped with 10 NVIDIA RTX Pro 6000 GPUs (96 GB each), 192 CPU cores, 2 TB RAM and 100 GbE connectivity, reinforcing AI and high-performance computing capabilities.

Impact: significant expansion of compute capacity, strengthened support for AI workloads, and improved high-throughput research infrastructure.

Open-source governance support
SAS contributed to the institutional open-source initiative by supporting the development of INESC TEC's open-source software guidelines and onboarding procedures, in coordination with TTO and CPES.

SAS also jointly implemented with CPES the INESC TEC Open-Source website (https://oss.inesctec.pt/) and provides technical support for publishing projects under the INESC TEC GitHub organisation.

Impact: strengthened governance of open-source software, improved institutional visibility of research outputs, and ensured secure and standardised publication processes.

11.14 INFRASTRUCTURE MANAGEMENT SERVICE

Manager: Jorge Couto

Employees
6 Men
1 Women

Presentation

The Infrastructure Management Service assures the support services necessary for the adequate management and maintenance of INESC TEC buildings infrastructures.

Highlights in 2025

Increase energy efficiency of buildings:

- Acquisition and installation of a heat pump to air-condition the buildings, as well as rearranging all pipes and valves for this purpose;
- Energy certification of the two buildings in Asprela;
- Purchase of 20 additional photovoltaic panels to increase electricity production;
- Installation of an electrical panel for the data centre to handle the significant power increase of the computational cluster.

Power to this panel was supplied directly from our redundant power transformers so that it would never run out of power if one of the transformers failed.

Security

- Preventive and corrective maintenance of the various firefighting devices installed in all buildings with the monitoring and supervision of a technician accredited by ANEPC and the fire brigade. Preventive and corrective maintenance of the various fire control devices installed in all the buildings.

Workspace improvement

- Installation of two acoustic booth to support web meetings;
- Renovation of the videoconference system in the meeting rooms on the 4th floor;
- Installation of a videoconference system in Auditorium A;
- Improvement works at the University of Minho Centre in Braga;
- Improvement of the CRAS space, based at ISEP, with the construction of a mezzanine to improve and enhance working conditions for our employees. This was a major project involving metalwork, air conditioning and electrical work.

Team Development

- Training of team members in workplace safety, electricity, and English language skills.

Other activities

- Continued maintenance of building infrastructure and systems.

12 RESEARCH INFRASTRUCTURES

12.1 Tec4Sea - Technologies for the Sea

Mission and positioning

Tec4Sea's mission and positioning have not changed. It continues its pledge and main mission of supporting multidisciplinary research, development, and test of marine robotics, telecommunications, and sensing technologies for operation in oceanic environments. It is open to both the R&D community and the industrial sector, thus providing the equipment, expertise, and logistics needed to support those communities in developing, evaluating, and validating technological solutions designed for maritime environments, thus fostering and advancing the blue economy.

Its geographic location (allowing fast access to deep sea), multidisciplinary nature, and vertically integrated structure are vital assets in supporting the development, evaluation, and validation of technological solutions designed for the ocean environment, allowing researchers to evolve from simulation/lab experiment to deployment and field trials. Its focus on ocean technology development–not on the ocean itself–and structural characteristics define it as a unique research infrastructure in Europe. Tec4Sea has poles in Porto and Faro, two major coastal cities in Portugal.

Tec4Sea has three main objectives: supporting the R&D community and the industrial sector (by making available facilities, resources, and know-how to economic agents and researchers), and pushing the technological envelope in developing technology for maritime environments.

Main achievements in 2025

Since the teams and resources involved in the Tec4Sea infrastructure are also the laboratories, resources and teams of the host institutions (Tec4Sea has no legal, financial, budgetary, or patrimonial autonomies), the internal activities on the infrastructure (in support of the host institutions' needs) are a subset of the activities of the associated laboratories and teams and are, thus, included in the reports of the research centres to which those teams and resources belong. To avoid duplications, this report will, therefore, summarize only the external activity of the infrastructure: that is, services provided explicitly by the infrastructure to external communities.

In 2025, all the external service requests received by the infrastructure were related to either the employment of the Mar Profundo research vessel or (often cumulatively) to the use of some of the equipment and skill sets of the marine robotics team.

The vessel's usage has been growing over these first 4-5 years, and in 2025 we completed 59 mission days, well on the way to the 100 days of annual operation that we consider to be the practical limit for this vessel. Of these 59 days on mission, 12 were used in support of European projects, 38 in support of external communities, and 9 were in internal activities (equipment testing, mission preparation, etc.) and participation in the REPMUS25 (one of the main international military robotic exercises). This means that 64% of the vessel's usage was affected to the support of external communities.

One of the most relevant external support missions in 2005 (most relevant because it lasted a full 18 days) was the support to a geophysical survey of a marine area assigned to offshore energy production, to support the requesting economic agent's decision on the adequacy of the area for the intended investment. This a paradigmatic example of the usefulness of the TEC4SEA infrastructure in fostering and supporting the blue economy. Other relevant examples were the monitoring and evaluation of deep marine ecosystems (for a state-owned entity), and the support to the evaluation of quality levels in water column and sediments along the Portuguese coast (again, for a state-owned entity)

Concerning updates to the vessel, the most relevant action in 2025 was the completion of the dynamical position (DP) capability (a pre-fitting had been completed in late 2024, which involved opening the hull and adding four new electric motors), with the completion of the command-and-control station (involving both its hardware and control algorithm). This capability will make the vessel capable of performing more sophisticated and demanding types of mission.

12.2 EMSO-PT - European Multidisciplinary Seafloor Observatory – Portugal

Mission and positioning

EMSO-PT is a research infrastructure led by IPMA (Instituto Português do Mar e da Atmosfera) and involving 17 other research institutions working on ocean science or technology, including INESC TEC.

The ultimate goal of EMSO-PT is to organize the Portuguese contribution to the EMSO-ERIC network, a large-scale European Research Infrastructure, networking fixed point, deep-sea multidisciplinary observatories, with the scientific objective of real-time, long-term monitoring of environmental processes related to the interaction between the geosphere, biosphere, and hydrosphere. It is a geographically distributed infrastructure at key sites in European waters, spanning the Arctic, the Atlantic, and the Mediterranean, up to the Black Sea. It will be in place by the end of the decade.

EMSO identifies eight main scientific questions where advances are foreseen: 1) Dynamics of tectonic plates and magmatic systems; 2) Climate and greenhouse gas cycling; 3) Ocean productivity and ocean dynamics; 4) Marine mammal and fish stocks; 5) Non-renewable marine resources; 6) Episodes, events and catastrophes; 7) Origins and limits of life; 8) marine ecosystems dynamics. All these topics are dependent on long-term, continuous observations, able to capture significant episodes as they occur.

So far, the Portuguese participation in EMSO has been focused on the Azores and Cadiz nodes, in cooperation with France (Azores) and Italy (Cadiz) using two of the few available technological solutions for long term seafloor monitoring (ASSEM and GEOSTAR). Within the scope of EMSO-PT two sites will be considered close to the mainland: a deep water one, located in the Gulf of Cadiz, and another shallow water, located off North Portugal. The later one will also be a test bench for emerging monitoring strategies.

EMSO-PT observatories will merge “off-the-shelf” technology, which will ensure that they meet the international standards, with novel approaches (based on networked, autonomous observation platforms) that will contribute to more sustainable monitoring operations and will create the basis for the development of new marine products and services, creating value and qualified jobs.

INESC TEC involvement in EMSO-PT addresses the establishment of long-term non-fixed observatories. Such work is organised along two complementary lines: relocatable nodes and long-endurance mobile platforms. In the first case, INESC TEC is building an EGIM (EMSO Generic Instrument Module) for integration and use in a Turtle relocatable node. In the second one, INESC TEC is implementing a network of underwater gliders for collection of oceanographic data.

While the goal of the EMSO-PT infrastructure is the implementation of a network of ocean observatories for data gathering, the underlying activities are aligned with the CRAS research line associated with long-term deployments.

INESC TEC core research team associated with this infrastructure includes Eduardo Silva, Aníbal Matos, José Almeida, Alfredo Martins, Hugo Ferreira, Nuno Cruz and Nuno Abreu.

Alfredo Martins is currently the Engineering and Logistics Service Group leader on EMSO ERIC and a member of the executive committee.

Main achievements in 2025

EMSO-PT finished its first implementation phase in 2023. In 2024 and 2025, there was continued participation in the international EMSO-ERIC activity, during which the infrastructure strategy was discussed, and further work was planned for the following years.
Funding is expected for 2026 to implement the strategy to continue developing the infrastructure.

12.3 Robotics and Autonomous Systems Laboratory

Mission and positioning

The Robotics and Autonomous Systems Laboratory has two physical locations within the ISEP and FEUP campuses. These dedicated facilities support R&D activities, technical training of human resources, and advanced education programs. In fact, as a research lab in an academic environment, it fosters undergraduate research and supports multiple engineering courses and academic activities. The mission of the laboratory is to support research of excellence in Autonomous Systems, enabling observation and operations in complex, unstructured, and harsh environments. The multiple-purpose robotic operations include data gathering, inspection, mapping, surveillance, and/or intervention. The impact on the economic and social fabric development is also part of the objectives, by contributing to the performance, competitiveness, and internationalisation of Portuguese companies and institutions. The total area of the laboratory exceeds 1000m2, distributed in two campuses: ISEP and FEUP. The overall facilities include two test tanks, the largest of which is 10mx6m and 5m deep, and a prototyping workshop. The laboratory's infrastructure includes a large set of robotic platforms (underwater, surface, aerial, and terrestrial), most of which are ready to operate in real environments. It also includes many sensors and auxiliary equipment that can be operated independently or integrated into larger systems. These assets contribute to great operability and have been key to establishing national and international partnerships.

Main achievements in 2025

The main achievement of the Robotics and Autonomous Systems Laboratory in 2025 addressed 3 areas:

1. **Lab space and infrastructure**

   The work to reorganise the physical space on the ISEP campus has been completed, with the creation of a mezzanine in part of the open space, which has made it possible to create more workspaces for staff and students, with improved conditions, as well as a better-organised space for the storage of components and equipment. The overhead crane has also been upgraded, with its length extended to improve equipment handling.

2. **Human Resources**

   In collaboration with CRIIS, a skills matrix for the field of robotics has been developed to identify essential skills, establish a strategy for team development, and provide support for the training and upskilling of our staff.

   A group of researchers is continuing the basic training course in maritime safety and survival techniques, with a view to testing prototypes in operational environments on offshore platforms.

3. **Lab prototypes and subsystem**

   Launch of a major upgrade cycle of robotic platforms and laboratory infrastructure, driven by new projects and PRR-funded investments, targeting enhanced capabilities across UAVs, ASVs, AUVs, landers, and buoy-based systems.

   Acquisition of state-of-the-art sensing and actuation systems (e.g., multibeam and imaging sonars, high-resolution cameras, underwater manipulators), together with expanded prototyping capacity through new fabrication equipment (e.g., 3D printers), enabling faster development and integration of mechanical and electromechanical subsystems.

   Ongoing integration of these systems into platforms, involving upgrades to onboard computing, communications, and software architectures (navigation, perception, control, and real-time data processing), with phased delivery, testing, and validation extending through mid-2026.

12.4 Laboratory of Microfabrication

Mission and positioning

The Microfabrication laboratory explores non-traditional microfabrication techniques based on femtosecond laser direct writing processes. For example, microfluidics and optofluidics chips are produced to implement biosensors and micro and nanostructures. First order Bragg gratings are made by laser point-by-point direct writing leading to the development of better and more reliable sensing heads. Fabrication of optical waveguiding structures as well as polymeric 3D structures fabricated by multi-photon absorption are commonly produced. Laser marking and surface treatment is also possible.

Main achievements in 2025

At the end of the first trimester, the femtosecond laser was re-installed after a complete refurbishment process, and its performance has now been fully restored.

The main topics where the lab had significant contributions were:

- Optofluidics based on glass capillary machining and the incorporation of optical fibers (patent submitted). This work continues previous efforts, with additional functionalities being integrated into the devices.
- The design of sensing devices based on the fabrication of cantilevers by glass micromachining has started, following an alternative approach that does not rely on Bragg gratings within the cantilever.
- The fabrication of Bragg gratings in planar format has been improved.
- The fabrication of low-loss waveguides has been demonstrated in borosilicate glasses using laser multi-scan techniques combined with annealing. These waveguides show superior performance in the visible wavelength range compared to those fabricated in pure silica substrates.
- The fabrication of active integrated optics devices has been demonstrated using the thermo-optic effect.
- Initial steps towards the production of integrated optics devices based on Thin Film Lithium Niobate (TFLN), using femtosecond laser direct writing, have been taken.
- For the development of plasmonic sensing structures, significant effort has been devoted to the use of laser direct writing and multiphoton absorption as a lithographic process. The fabrication of structures with dimensions as small as a few hundred nanometers has been demonstrated. This work progressed more slowly due to the lack of local access to an electron microscope.

The Bragg and long-period gratings fabrication setup underwent a renovation process, including the installation of new drivers and air-bearing X–Y stages, the rewriting of control software, and improvements to the optical hardware. The system underwent its first tests during the year.

The fabrication capabilities are complemented by equipment available at CEMUP – MNTEC. The cleanroom is a service-oriented laboratory managed by the University of Porto, supported since its creation by INESC TEC, which has made its micro- and nanofabrication equipment available within this infrastructure for broader use.

12.5 x-Energy Lab - Smart Grids and Electric Vehicles Laboratory

Mission and positioning

The x-Energy Lab's mission is twofold: a) enable the application of concepts, algorithms, and scientific insights developed in the Power and Energy Systems domain, encompassing activities ranging from basic prototypes or proof-of-concept designs to fully operational demonstrators deployed in the field; b) foster the creation and transfer of scientific knowledge in collaboration with industry, while offering services, technical training and educational opportunities to industrial partners and academic institutions. The x-Energy Lab focuses on four primary areas: smart grids, electric mobility, energy management, and power electronics. x-Energy Lab activity is driven by its dedicated I&D staff and by senior academic researchers collaborating closely with the Power and Energy Systems domain, along with graduate students conducting their research at x-Energy Lab.

Main achievements in 2025

The main achievements of the RI for the year 2025 were the following:

- Hybrid AC/DC distribution grids: Completion of AC/DC and DC/DC converter prototypes initiated in the scope of P2020 SmartGlow project (PRR). Commissioning of a new AC/DC electric panel using PRR funding, to be installed in 2026.
- EV charging: Continued development of the EV smart charging testbed, with new prototypes for a Charging Station Management System (CSMS) (PRR), AC EVSE with V2G capabilities (H2020 POCITYF, HE GreenDataAI, and PRR), and DC charger and EV simulator for DC charging (PRR). Relevant standards were incorporated and validated in the developed solutions aiming to support pre-certification services for EV smart charging appliances and create new solutions for interoperability between EVSE, distributed energy resources, and household/building loads: OCPP 2.0, ISO 15118-2/20, IEC61851-23.
- Energy Storage: Energy storage capacity reinforced with a new 100kWh/40kW storage system (PRR project Next Generation Storage (NGS)).
- Power Grids dominated by Power Converters: Implementation of a testbed for low inertia power grids with a 15kVA grid forming converter and a 40kVA motor-generator group capable to operate as synchronous condenser, which now supports the realistic emulation of the static and dynamic behaviour of electricity grids with synchronous generator emulation.
- IoT and Legacy Gateway: Development of gateway prototypes for IoT and Legacy applications in the context of integration of distributed energy resources. These prototypes offer controllability capabilities to legacy devices not natively prepared for remote control and provide mobile communications capabilities to the same devices.
- Hydrogen: Continued development of a laboratory-scale green hydrogen test bed for testing of a proton exchange membrane (PEM) electrolyser, and the respective power electronic interface (PRR H2Driven project) for ancillary services provision, namely frequency and voltage ride through capability services.
- Important advancements were made in the development and capacity-building for new services to industry (PRR): the service offering was improved and refined, and internal procedures to organize, deliver, and document service provision were developed..

12.6 BRAIN Lab - Neuro-Engineering Lab

Mission and positioning

The Neuro-Engineering laboratory, a.k.a. BRAIN (Biomedical Research And INnovation) has a strong focus on researching new biomedical engineering methods for neurosciences & neurological diseases (e.g., Parkinson's, Alzheimer's, Autism or Epilepsy) and is divided in 5 main research lines: 1)Brain imaging (&signals); 2)Man-machine symbiosis with edge-AI (e.g. Brain-Computer Interfaces); 3)Multimodal Computer Vision Analysis for neurological diseases; 4)Neurosurgery Aiding Systems; and 5)Macro-to-nano bio(neuro)sensing.

Part of BRAIN-lab is the Stim-BRAIN Lab which is an advanced Brain Imaging infrastructure (that offers scientific services to third-parties, apart from our own research project) with an f-MRI simulator (mock scanner) fully equipped with synchronised 64ch video-Electroencephalogram(EEG) medical systems from Micromed, wearable EEG devices, 3D video cameras, MRI compatible pads and audio system to simulate f-MRI experiences and prepare stimulation protocols to be deployed in MRI scanners at any clinical centre. This infrastructure is used for fMRI and Video-EEG-fMRI paradigms development and testing for neuroscience projects with our clinical partners and students.

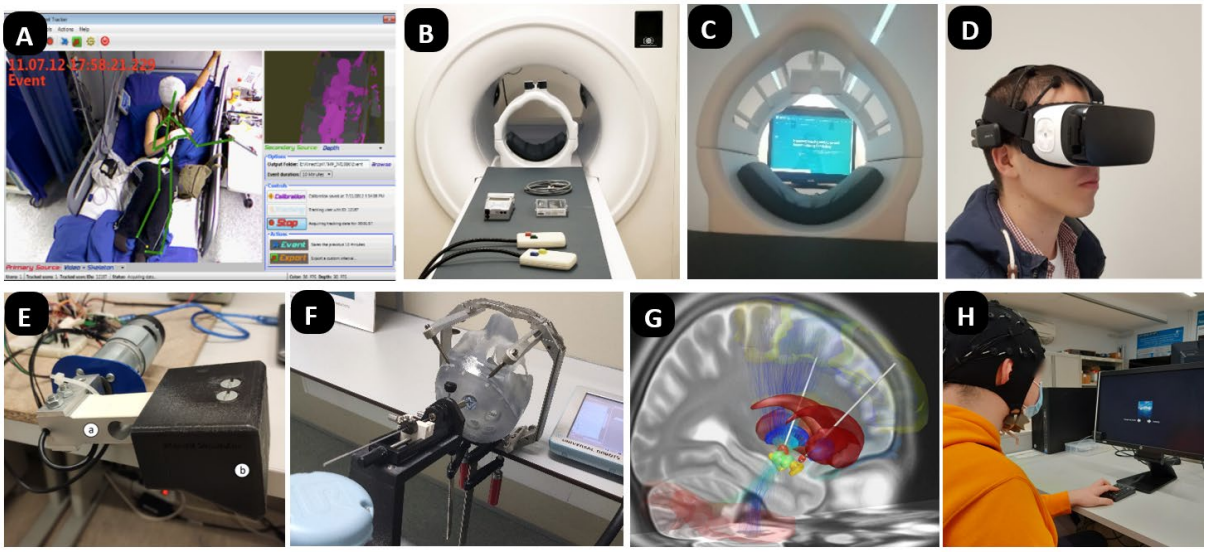
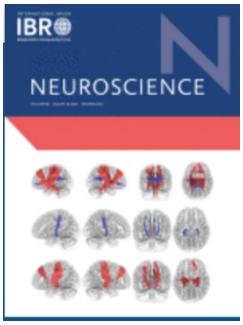


Figure 12.1 - Some BRAINLab infrastructure and research projects examples. A- Neurokinect System interface; B/C- fMRI simulator for experimental design and training; D- Combination of EEG-wearable devices and Virtual reality to study psychophysiological states; E- Robotic wrist for wrist rigidity simulation; F- Surgical robot simulating automatic DBS electrodes precise adjustment based on real-time iHandU wrist rigidity quantification; G- 3Dmodel of brain structures and DBS stimulation electrodes position analysis to study electrodes position and brain stimulation connectivity; H- Experimental paradigm to correlate neuronal activity with memory recognition.

Main achievements in 2025



BRAINlab research in neuroimaging makes the cover of the official journal of the International Brain Research Organisation (IBRO) - Neuroscience, from Elsevier.

WeFetal Technology: A prototype system from our lab to detect, quantify, and locate fetal movements in real-time at home, received a BIP PROOF prize from University of Porto to support its further development and perform a validation clinical study.

BRAINlab research in neuroengineering was published in a top-ranked scientific journal in the field of Artificial Intelligence. The paper "Exploring image- and skeleton-based action recognition approaches for clinical in-bed classification of simulated epileptic seizure movement" was published in the journal Expert Systems with Applications (Elsevier), which is, according to Google Scholar, the top-ranked scientific journal in the field of Artificial Intelligence. IEEE AI Research Hub Prize @GITEX Global 2024: Our UP-CMU PhD Student Tamás Karacsony won this prize promoted by IEEE at the largest tech and startup exhibition in the world held in Dubai with his work on AI for neurology video processing.

12.7 iiLAB - Industry and Innovation Lab

Mission and positioning

To disclose the state-of-the-art in advanced production technologies through the demonstration of research results, experimentation, and advanced training initiatives. iiLab fosters technology-driven innovation in public and private organisations, enhancing their capabilities in developing, adopting, and implementing advanced production technologies. This, in turn, promotes sustainable competitiveness within the circular economy.

- Development and demonstration of concepts and advanced technologies in the areas of robotics, automation, industrial cyber-physical systems (Internet of things) in the form of a show-room.
- Dissemination of INESC TEC's expertise for the industry and the community in general.
- Experimentation and prototyping space for technological companies.
- Tailor-made training for senior managers and senior executives of industrial companies.

Main achievements in 2025

In 2025, in line with what was established in the activity plan for that year, various activities were carried out in conjunction with INESC TEC's Centres, with the following being particularly noteworthy:

- Three pilots associated with the 5G Testbed were developed in collaboration with NOS, fostering new initiatives and helping to enhance and maximise the benefits of the dedicated 5G network infrastructure.
- iiLab supported more than 13 INESC TEC R&D projects involving industrial PhDs, contributing to the integration of two new doctoral students, the completion of two doctoral degrees, and the publication of nine papers in leading scientific journals and international conferences.
- Two executive training programmes - Programa Avançado em Industry 4.0 and Digitalização Shopfloor - were delivered, both with a strong practical component grounded in research results, and attended by 24 participants from industry.
- iiLab also supported the licensing of technology-based products and services to industry, contributing to the transfer of research results into market-oriented applications.
- In addition to these internal achievements, iiLab further strengthened its external visibility and outreach through several initiatives, including: the workshop "How can Artificial Intelligence tools contribute to improving robot capabilities?", the iiLab Open Day held in the context of PRODUTECH Summit, co-promoted with NOS, and the "Café de Ciência: A Sustentabilidade na Robótica" pre-event of the European Researchers' Night. Together, these initiatives helped position iiLab as a dynamic space for demonstration, interaction, and engagement with industry, researchers, decision-makers, and the wider community.
- iiLab also received an institutional visit by Pedro Dominguinhos, President of the National Commission for Monitoring the Recovery and Resilience Plan (CNA-PRR), during which iiLab presented advanced production demonstrators and more than fifth PRR-funded projects, reinforcing iiLab's role as a bridge between applied research, technology transfer, and industrial innovation. iiLab also received a visit by José Pulido Valente, Chairman of IAPMEI, during which iiLab's track record in promoting science-based innovation in industry, services, and public administration was presented.
- Development of new demonstrators and associated platforms, namely: a new, in-house developed mobile manipulator demonstrator for decontainerisation; a new mobile base for developing a new version of the mobile manipulator for decontainerisation; a new demonstrator for a pallet and pallet-pocket detection system. In 2025 the research centre CEGI also joined the iiLab infrastructure, by developing a new demonstrator in pallet and container loading optimisation for decision making, integrated with robotic systems, towards logistics optimisation.
- Hosting visits from over 50 companies.

12.8 TRIBE LAB - Laboratory of Robotics and IoT for Smart Precision Agriculture and Forestry

Mission and positioning

The (TRIBE LAB) laboratory of Robotics and Internet-of-Things (IoT) for Smart Precision Agriculture and The (TRIBE LAB) laboratory of Robotics and Internet-of-Things (IoT) for Smart Precision Agriculture and Forestry was conceptualised in 2013 with a clear mission: to pioneer robotics, automation, and IoT-based solutions. Our aim is to revolutionize smart precision agriculture and forestry, ensuring that operations are conducted at the "time, right tool/product, right amount, right" for optimal outcomes. We focus on enhancing profitability, sustainability, and automation across three primary environments: Permanent Crops, Forest biomass harvesting, and Protected Cultivation (Greenhouses and Controlled Environment Agriculture). Our research, development, and technology deployment activities are guided by a comprehensive ten-year roadmap (2020-2030), meticulously aligned with European agendas, FAO's agricultural priorities, and the TEC4AGRO-FOOD Innovation Area agenda. By addressing societal challenges and leveraging cutting-edge innovation, we strive to be at the forefront of transforming the agricultural landscape for a sustainable future. TRIBE LAB has a multi-disciplinary team and operates with dynamic flexibility, focused on research and developing cutting-edge physical prototypes. We have the capability to quickly create prototypes on demand, ready to address emerging societal challenges. Research Team: Filipe Neves Santos (PhD), António Paulo Moreira (Prof. PhD), Mário Cunha (Prof. PhD), José Boaventura (Prof. PhD), António Valente (Prof. PhD), André Aguiar (PhD), Luís Santos (PhD), Pedro Moura (MSc), Sandro Magalhães (PhD), Daniel Silva (PhD),Vítor Tinoco (PhD), Francisco Terra (MSc), Ricardo Neves (MSc), Humberto Rocha (MSc), Isabel Pinheiro (PhD candidate), Miguel Marques (PhD candidate), José Sarmento (PhD), Renan Tosin (PhD), André Baltazar (PhD), Domingos Bento (MSc), Francisco Oliveira (PhD candidate), Germano Moreira (PhD candidate), Igor Portis (PhD candidate), Leandro Rodrigues (PhD candidate), Rui Coutinho (PhD candidate), Pedro Meireles (MsC), Joana Pereira (PhD Candidate), Pedro Rodrigues (PhD Candidate), André Pires (PhD Candidate), João Castro (PhD Candidate),José Miguel Santos (MsC Candidate). Reference Centres: CRIIS (Leader), CAP, CESE, HumanISE, HASLAB, LIAAD, CITE.

Main achievements in 2025

In 2025, INESC TEC reinforced its international standing in agricultural robotics through award-winning results and continued innovation. At FIRA 2025, Modular E received the Silver Medal for Best World FIRA Robot for the second consecutive year, while also winning first place in the "Prémios Inovação Agricultura 2024" and being selected again as a finalist for the Innovation Vanguard Awards. In parallel, the SmartFarm 4.0 project was chosen as one of the 25 finalists of the "Prémio dos Fundos Europeus".

The year also included further progress in technology valorisation, with the launch of the Vifield start-up, alongside advances in dual-use robotics and strategic initiatives. Modular E had already been showcased at ARTEX 2024, and in 2025 Modular X was presented in the same context, leading to a cooperation project with CEMTEx to develop a logistics and CASEVAC variant. INESC TEC also launched the ECOBOTS.pt initiative, bringing together key Portuguese end users and technology providers in agriculture and forestry, and assumed leadership of VineShield DT, a digital twin for pest spread prediction and management. At European level, participation began in the AgroBoost project, which will deploy Modular X with AI-based robotics for pruning and flower thinning in INIAV orchards.

Across the year, 28 software and hardware prototypes were developed, reaching an average TRL of 7 and moving closer to real-world deployment. Flagship platforms such as Orioos and Modular X supported technology transfer and contributed to Horizon Europe, H2020, and PRR-funded projects including NOVATERRA, WATSON, Agenda Transform, Vine&Wine, InsectERA, and Blockchain.PT. TRIBE LAB also organised eight public demonstrations and showcased its work at events such as FIRA 2025, Agroglobal, and Synergy Day 2025, while gaining further visibility through Euronews coverage during the WATSON pilot at Quinta do Seixo.

Academically, the laboratory maintained strong output, with two completed PhD theses, 27 peer-reviewed publications, and seven master's theses. Public engagement also remained significant, with more than 40 media features and participation in major events such as ROBOT 2025, ICARSC 2025, World FIRA 2025, and ARTEX 2025. Overall, in 2025 TRIBE LAB reaffirmed its role as a leading force in Robotics and IoT for agriculture and forestry, combining scientific excellence, field validation, industry collaboration, and growing capacity for technology transfer.

12.9 MASSIVE – Multisensory Virtual Reality Laboratory

Mission and positioning

MASSIVE (Multimodal Acknowledgeable multiSenSory Immersive Virtual Environments) is an INESC TEC research infrastructure dedicated to research and development of multisensory virtual reality and immersive experiences. Focused on the relationship between technology and human performance, it fosters scientific and technological innovation, advanced training, and interdisciplinary collaboration, thereby advancing knowledge and creating solutions with a positive social impact.

MASSIVE operates at the intersection of technology, science, and human experience, applying immersive virtual reality across multiple sectors. In education and training, we design environments that enhance learning, skill acquisition, and professional certification through realistic simulations. In health and well-being, we explore immersive systems that support rehabilitation, therapy, and stress management. In industry and safety, we develop solutions that optimise performance and decision-making in complex or high-risk environments. We also collaborate across tourism, cultural heritage, and public engagement, creating interactive experiences that expand accessibility and promote knowledge dissemination. Our multidisciplinary approach ensures that each project combines scientific rigour, creativity, and societal relevance.

Our laboratory is currently equipped with state-of-the-art technologies that enable our researchers to meet the challenges of using computational techniques, from which we highlight:

- Optitrack tracking system with 12 cameras
- Ambisonics sound system
- 3D sound capture
- Scent machines
- Omnidirectional walkways
- Haptic simulators
- Eye trackers
- Scent capture
- Immersive 3D digital twin capture systems

At MASSIVE, we showcase a range of technological demonstrators that illustrate our ability to combine immersive virtual reality, human performance analysis, and integration with real-world systems. Each demonstrator represents a use case applicable to industrial, healthcare, logistics, or cultural contexts, serving to test concepts, validate hypotheses, and demonstrate real-world impact.

Main achievements in 2025

During 2025, we highlight the following achievements:

- Kick-off of SmartCUTv2 project, devoted to the development of an immersive agroforestry simulator for training;
- Development of immersive virtual reality scenario authoring tools for industry training;
- Publication of 10 scientific papers, five of them in well-known journals in the field, such as Virtual Reality Journal, Computer Graphics Forum, and International Journal of Human–Computer Interaction, and an honourable mention for a publication at the International Conference on Graphics and Interaction 2025;
- Award of two strategic projects to kick off in early 2026 (ImmersiveSGS and IMAGINE-VR).
- Several activities to promote pedagogical innovation and new technologies in education, namely: two pedagogical innovation projects that aim to integrate virtual reality technologies in domains such as foreign language learning, veterinary sciences, and computer graphics; and two workshops for teachers on how to adopt virtual reality technologies in their teaching activities.
- Concluded supervisions of 2 PhD students and 2 MSc students.
- Dissemination activities to society, including 12 school visits to the Laboratory involving around 300 students and 5 public dissemination sessions.

12.10 GIG – Laboratory of Graphics, Interaction and Games

Mission and positioning

The mission of GIG (Graphics, Interaction and Games) is to perform high-level research and development on immersive environments with a view to enhancing human capabilities, and with a focus on interaction and inclusion.

GIG research infrastructure focuses on the interdisciplinary field of "Human Augmentation", addressing methods and technologies to improve the perception, performance and/or cognitive capacities of human beings, enhancing inclusion. The concept of immersion is central, integrating areas such as Computer Graphics, Human-Computer Interaction and Digital Games. Technologies and solutions are developed to improve the user experience and accessibility, being these to be applied to various domains.

The research conducted at GIG focuses on user experience and the creation of interactive, immersive, and engaging devices and content, with applications in various fields, including industry, security/defence, health, training, tourism, and culture. The creation of location-based educational games and augmented reality, the use of haptic devices for immersive environments, 3D interaction and immersive data analytics and visualisation are all components that are explored and enhanced in different ways.

Through the research and development work carried out at GIG, we offer the following competencies:

- Creation and co-creation methods for designing technological solutions, immersive environments and serious games;
- Development of immersive technologies for industry, defence, education, culture, tourism, oceanography, health and well-being;
- Analysing and developing immersive interactive techniques and devices suitable for specific situations, for instance, using multisensory stimulation;
- Consultancy in collaborative immersive environments;
- Immersive and interactive data analysis and representation;
- Specialised training with certification.

Main achievements in 2025

In 2025, members of the groups published in important, recognised international venues. In total, five articles have been published in journals Q1, three in journals Q2; one article has been published in a conference CORE A*, three in CORE A and four in CORE C; three volumes have had their editorial involvement.

Studies and developments in this lab include haptic device prototypes for 3D immersive interaction. Two prototypes were developed and published internationally; one received the best paper and the best presentation awards.

Also, in the context of the work developed in Digital Twins, a patent was proposed; it refers to the VChor (Virtual Choreographies) framework, a modular and semantic solution for orchestrating and visualising federated Digital Twins in an interoperable manner, decoupling behavioural logic (the “what/where/when” agents do in time and space) from visualisation and interaction. Studies and contributes to Oilspill/Microplastics dispersion visualisation and exploratory scientific visualisation (the context is Digital Twin of the Oceans).

Co-Creation and Co-Design were also important areas of work, namely in the form of workshops for the ideation of augmented reality experiences/games in museums. We also developed a workshop "Co-Creating Innovation through Ideation", a gamified method for engaging experts in the design of solutions for health system challenges. In the context of the EUGLOH alliance, we were involved in the Co-design of a framework for transversal skills and in the Co-creation of a living lab on pedagogical innovation, including 4 courses. The BIP Serious Games for Global Health Education, developed within the EUGLOH alliance, is a five-day intensive course focused on the design and development of serious games for health and

well-being. A subsequent edition was delivered at LMU Munich, invited by EUGLOH, to advance competencies in Global Health innovation.

In 2025 we concluded the project "Frontowns" and saw a new project approved, "NUTLY 2.0" – Co-creation of a personalised digital tool for assessing nutritional literacy in Portugal [FCT project]. Many projects have been submitted in several contexts and programmes. In particular, two projects were submitted to EDF (European Defence Fund) and ten projects were submitted to Horizon Europe, focusing Health Clinics, Sign-Language teaching and learning, Digital Transformation of Industry, Cultural Heritage.

We were involved in the organisation of scientific conferences, as is the case of ICGI'2025 (International Conference on Graphics and Interaction, scientific and organisation committees members), ACM DIS 2025 (Designing Interactive Systems Conference, workshop co-chair) and VISIGRAPP 2025 (International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications, general co-chair).

12.11 Research Computing & Data Infrastructure

Mission and positioning

INESC TEC's Research Computing & Data Infrastructure provides the shared computational and data backbone supporting scientific research across the institution. Hosted at the institution's headquarters (data centre) and the University of Minho (CLOUDinha), it encompasses a diverse set of platforms designed to serve a broad spectrum of research needs, from general-purpose scientific computing and virtualised environments to GPU-accelerated workloads and bare-metal systems research

CCloud computing and virtualisation infrastructure. The CCloud cluster is INESC TEC's primary platform for high-performance, GPU-accelerated and virtualised workloads, built on OpenStack for resource management and orchestration. A self-service portal enables designated users within each Centre to provision virtual machines on demand, reducing turnaround times and giving research teams greater autonomy over their computing environments. By the end of 2025, following the integration of three new high-performance servers during the year, the cluster comprises approximately 3,200 physical CPU cores, 29.5 TB of RAM and 64 GPUs, interconnected via 25 and 100 Gbit/s networking. Of these, 35 GPUs are LLM-capable (including NVIDIA L40S and H200 models), providing a combined 617,000 CUDA cores, 2.6 TB of VRAM and 17,000 Tensor cores for machine learning, deep learning and AI research. CCloud also provides the computing backbone for the institution's MLOps platform, enabling scalable execution of ML workflows alongside the S3-compatible storage layer. Additionally, a dedicated GPU server with 10 NVIDIA RTX Pro 6000 GPUs (96 GB each), 192 CPU cores and 2 TB of RAM was ordered in late 2025, with delivery and deployment expected in early 2026.

Storage. The infrastructure includes two complementary storage systems. A conventional block and file storage system with 300 TB of capacity provides the reliable, high-performance disk infrastructure required for virtual machine disks and persistent workloads. A high-throughput S3-compatible object storage system, built in-house on open-source software and enterprise-grade hardware over a 100 Gbit/s Ethernet fabric, serves large-scale datasets, AI training pipelines, MLOps artifacts, and data-intensive workflows. The object storage environment comprises two clusters with 1.4 PB each, totalling 2.8 PB.

CLOUDinha computing infrastructure. Located at the University of Minho, the CLOUDinha infrastructure provides direct, bare-metal access to a heterogeneous pool of hardware for computer science and engineering research, while also supporting virtualised environments. The cluster comprises 106 commodity microATX servers spanning multiple hardware generations, equipped with Intel Core i3, i5 and i9 CPUs, up to 64 GB of memory, and heterogeneous storage including HDDs, SSDs and NVMe devices. These servers are interconnected via 1 Gbit/s or 10 Gbit/s networks and include programmable network cards from Intel and Netronome. Complementing these, four Intel Xeon rack servers provide extended computational and storage capabilities with up to 192 GB of memory, a tiered storage hierarchy that includes persistent memory, NVMe and SSDs, programmable network stacks (DPDK) and 10 Gbit/s connectivity. The cluster is also equipped with power measurement devices for energy consumption analysis. The bare-metal model gives researchers full control over the software stack, from operating system to application layer, enabling work on systems-level topics such as storage, networking, distributed systems and energy efficiency that requires unmediated hardware access.

MLOps platform. Following an evaluation of several platforms, a Kubernetes-native workflow orchestration solution was selected and deployed in pilot mode in Q4 2025. The platform allows researchers to define ML pipelines as code in Python, with declarative resource management that provisions compute, including GPUs, on demand for each task rather than keeping expensive resources idle between experiments. It provides built-in experiment tracking, automatic caching of intermediate results, data versioning and artifact management with full integration into the S3-compatible storage, and supports on-demand deployment of large language models (LLMs) for inference. Production deployment and institutional rollout are planned for 2026.

Main achievements in 2025

The Research Computing & Data Infrastructure supports, PhD, and MSc students across all centres, underpinning a significant portion of the scientific and technological work reported in this annual report.

Many of the scientific publications, software prototypes, proof-of-concept demonstrations, and completed theses (both PhD and MSc) presented by INESC TEC's research groups were only possible because of the computing capacity, storage, and services this infrastructure provides, from training deep learning models on CCloud's GPU nodes to running distributed systems experiments on CLOUDinha's bare-metal servers, or managing petabyte-scale datasets on the S3-compatible storage layer.

In previous years, these resources were presented separately, with specific laboratories highlighted as standalone research infrastructures while core computing and storage platforms were managed independently. In 2025, these capabilities are consolidated under the Research Computing & Data Infrastructure supports, reflecting an ongoing effort to maximize the synergy between the various platforms, presenting them as a single, coherent institutional offering and ensuring that the full breadth of INESC TEC's computing capabilities is visible and accessible to the research community.

Throughout the year, the infrastructure provided computational support for the development, optimisation, and evaluation of software systems and data-drive applications across the Computer Science and Engineering domain, and other interdisciplinary areas. These efforts span both fundamental and applied research, contributing a steady production of high-quality research outputs, including publications in leading international venues across AI, distributed systems, databases, operating systems, and software engineering fields, open-source software artefacts validated across a thorough experimental testbed, and contributed to technology transfer, industry collaboration, and the exploration of real-world use cases. Together, these results reinforce the role of the infrastructure as a bridge between research and practical application.

12.12 CommsLab – Communications Laboratory

Mission and positioning

The Communications Laboratory (CommsLab) supports the experimental evaluation and validation of next-generation communications, localisation, and sensing solutions, bridging the gap between simulation-based analysis and real-world deployment.

The laboratory provides a comprehensive experimental infrastructure spanning RF, optical, and electronic systems, including mmWave antenna characterisation, SDR and O-RAN platforms, LEO satellite communications, robotic platforms, and multimodal underwater communication testbeds.

In 2025, the CommsLab was significantly strengthened through the deployment of the CONVERGE Chamber, a new experimental space enabling the integration of vision and radio technologies. This infrastructure, fully controllable via API, combines a vision-aided 5G base station mounted on a robotic arm, a vision-guided RIS, and a high-precision motion capture system, enabling advanced experimentation in dynamic and controlled environments. Additional upgrades included the extension of the anechoic chamber capabilities to 170 GHz, the expansion of laboratory facilities, and the establishment of initial EMC/EMI pre-certification capabilities.

Main achievements in 2025

The CommsLab enabled a set of relevant scientific, technological, and training outcomes aligned with its mission:

Improve quality, management and usage of our infrastructures

- Deployment of vision-aided RIS and 5G experimental platform with API control: Implementation of an integrated platform combining a vision-aided RIS and an OAI-based 5G mobile base station mounted on a robotic arm, enabling controlled and repeatable experiments in dynamic scenarios.
- High-precision motion capture system for ground-truth-assisted experimentation: Deployment of a marker-based multi-camera vision system with sub-millimetre accuracy, enabling automatic ground-truth annotation of moving entities in communication and sensing experiments.
- Advanced experimentation in 5G/6G systems and O-RAN: Consolidation of SDR and O-RAN platforms enabled the development and testing of adaptive communication strategies, including object-aware control and integration with sensing and reconfigurable environments.
- High-frequency antenna and RIS characterisation: The upgrade of measurement capabilities to 170 GHz supported experimental validation of mmWave and sub-THz devices, including antennas and reconfigurable surfaces, contributing to ongoing research in beyond-5G and 6G technologies.
- Resilient communication solutions for emergency scenarios: Development and testing of obstacle-aware 5G and Wi-Fi-based communication strategies, leveraging UAV/UGV cooperation to improve connectivity and situational awareness in disaster scenarios.
- Multimodal and underwater communication systems: Continued experimental validation of integrated acoustic, RF, and optical communication solutions, supporting research in challenging propagation environments.

Provide innovative learning experiences

- Support to education and training activities: The CommsLab played a key role in supporting MSc and PhD research, curricular internships, and CTM Summer Internships, providing hands-on access to advanced experimental platforms and contributing to the training of highly skilled students.

Better align and deliver R&I with Industry's needs

- Strengthening industry-oriented experimentation: The upgraded infrastructure enabled joint activities with mobile operators and industrial partners, including initial validation of 5G-enabled solutions in realistic environments (5G Pilots).

13 GLOSSARY

Activity Profile – Classification of human resources based on their primary role or function within INESC TEC.

CoLAB (Collaborative Laboratory) – A research and innovation organisation in Portugal that brings together academia, industry and public entities to foster knowledge transfer and accelerate the adoption of innovative solutions, with a strong application and market-oriented focus.

Commercial Contracts (Licences, Options, Assignments) – Executed agreements with external parties for the licensing, optioning or assignment of INESC TEC intellectual property or other transferable assets, generating direct economic return to INESC TEC.

Completed PhD Theses – Members – Number of doctoral theses successfully completed by INESC TEC members acting as students, under the supervision or co-supervision of INESC TEC researchers.

Completed PhD Theses – Supervised – Number of doctoral theses successfully completed under the supervision or co-supervision of INESC TEC researchers.

Core HR – Human resources with a formal contractual or institutional connection to INESC TEC, including Employees, Faculty and Grant Holders.

Employees – Human resources holding a valid employment contract with INESC TEC.

EU Framework Programme – The European Union's main funding instrument for research and innovation, implemented through multiannual programmes that support collaborative projects across countries, organisations and sectors (e.g., Horizon 2020 and Horizon Europe).

External Researcher – Researcher who collaborates with INESC TEC on an occasional basis, either through a permanent affiliation with another organisation that authorises such collaboration, or through limited participation in activities requiring access to INESC TEC resources.

External Student – Student without a formal contractual relationship with INESC TEC, with occasional access to its resources.

Faculty – Researcher affiliated with a Higher Education Institution, typically through a formal HR assignment protocol, who carries out activities within an INESC TEC R&D Unit, usually on a part-time basis. This category also includes individuals previously designated as Affiliated Researchers, characterised by a link to a Higher Education Institution and limited participation in INESC TEC activities.

First Patents Granted – Patent families for which a first patent grant has been issued by a patent office, marking the first successful conversion of a filed invention into granted patent rights.

First Patents Internationalisation – First decisions to extend protection of a priority patent application to international or foreign jurisdictions, including PCT, EP, or direct foreign filings.

First Priority Patent Applications (New Inventions) – Initial patent filings that establish the priority date of a new invention, marking the first step in securing intellectual property rights.

Grant Holder – Researcher funded through a grant awarded under the regulations and funding schemes of the Portuguese Foundation for Science and Technology (FCT).

Indexed Articles in Journals – Scientific articles published in peer-reviewed academic journals that are indexed in recognised international bibliographic databases (ISI, Scopus via the Authenticus platform), ensuring visibility, quality standards and citation tracking.

Indexed Articles in Conferences – Scientific papers published in conference proceedings that are indexed in recognised international bibliographic databases (ISI, Scopus, and CORE via the Authenticus platform), reflecting peer-reviewed contributions presented at scientific conferences.

Management, Administrative and Technical Staff – Human resources holding a valid employment contract with INESC TEC and assigned to management, administrative or technical functions.

OP – Other Funding Programmes – Competitive research and innovation funding obtained from sources not covered in other classified categories, including miscellaneous or non-standard programmes.

PhD Students – Comprises human resources pursuing doctoral studies while carrying out activities at INESC TEC, including R&D Employees, Grant Holders and External Students.

PN-FCT – National R&D Programmes - FCT – Competitive research and development projects funded by the Portuguese Foundation for Science and Technology (FCT) under national funding schemes.

PN-COOP – National Cooperation Programmes with Industry – Competitive research and innovation projects developed in collaboration with industry partners at national level, typically co-funded, including projects supported under the Recovery and Resilience Plan (PRR).

PN-PICT – National R&D Programmes - S&T Integrated Projects – Competitive projects funded under the NORTE 2020 programme, supporting integrated research and innovation initiatives aligned with regional priorities.

Pre-Disclosures (PDF) – Preliminary internal submissions describing potentially impactful R&D results, made for early assessment of novelty, applicability, protection potential, and possible valorisation pathways.

PUE-FP – EU Framework Programmes – Competitive research and innovation projects funded under the European Union's Framework Programmes (e.g., Horizon Europe), supporting international collaboration.

PUE-DIV – EU Cooperation Programmes - Other – Competitive projects funded by European cooperation initiatives outside the main EU Framework Programmes, including transnational and interregional funding schemes.

Recovery and Resilience Plan (PRR) – A national programme, aligned with the European Union's Recovery and Resilience Facility, covering the period 2021–2026, that supports reforms and investments aimed at promoting economic recovery, resilience, and sustainable growth, particularly in response to the impacts of the COVID-19 pandemic.

Researchers – Reporting category comprising R&D employees, R&D employees with PhD, Faculty and Postdoctoral Grant Holders engaged in research activities at INESC TEC.

Researchers with PhD – Comprises researchers holding a doctoral degree, including R&D Employees with PhD, Faculty and Postdoctoral Grant Holders.

R&D Employee – Researcher holding a valid employment contract with INESC TEC and engaged in research and development activities, either on a temporary or permanent basis.

R&D Employee with PhD – Researcher holding a doctoral degree and a valid employment contract with INESC TEC, engaged in research and development activities.

SERV-NAC – R&D Services and Consulting - National – Research, development and consulting services provided to national entities, including companies and public organisations.

SERV-INT – R&D Services and Consulting - International – Research, development and consulting services provided to international clients, including companies and organisations outside Portugal.

Spin-off in Development – Internal entrepreneurial project, currently in development, aimed at creating a new tech-based company to exploit INESC TEC's intellectual property and/or whose promoting team includes at least one INESC TEC researcher, staff member or alumnus.

Spin-off – Incorporated tech-based company founded by at least one INESC TEC researcher, staff or alumni and established to commercialise INESC TEC's intellectual property.

Technology Disclosures (TDF) – Formal internal disclosures of inventions, software, data assets, methods, or other protectable or transferable results, submitted for evaluation of ownership, intellectual property strategy, and exploitation potential.

Technology Readiness Level (TRL) – A scale used to assess the maturity of a technology, ranging from basic research (TRL 1) to fully developed and commercially deployed systems (TRL 9).

Total Research Team – Comprises Researchers and PhD students, avoiding double counting by ensuring that individuals belonging to both categories are counted only once.

Trainee – Student engaged in activities at INESC TEC under an internship contract or equivalent formal agreement, including the development of a thesis or dissertation or the undertaking of initial research activities.

Type of Connection – Classification of human resources based on their contractual or institutional relationship with INESC TEC.

Visiting Researcher – Researcher or faculty member affiliated with another institution who carries out research activities at INESC TEC for a defined and limited period.

14 ANNEX I

14.1 CTM – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present CTM research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.1 – CTM – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	12,5	13,9	13,6	-0,3
	R&D Employees	*2,4*	*4,0*	*4,1*	*0,1*
	R&D Employees with PhD	*9,1*	*8,9*	*8,5*	*-0,4*
	Mgmt, Admin. & Technical	*1,0*	*1,0*	*1,0*	*0,0*
	Faculty	23,3	23,2	23,3	0,2
	Grant Holders	58,5	85,0	84,8	-0,2
	Total Core HR	94,2	122,0	121,7	-0,3

Table 14.2 – CTM – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT	103	169	66	-103
PN-PICT	National R&D Programmes - S&T Integrated Projects	32	3		-3
PN-COOP	National Cooperation Programmes with Industry	671	939	1 035	96
PUE-FP	EU Framework Programmes	983	1 256	1 484	228
PUE-DIV	EU Cooperation Programmes - Other	9	13	5	-8
SERV-NAC	R&D Services and Consulting - National	235	30	54	25
SERV-INT	R&D Services and Consulting - International				0
OP	Other Funding Programmes	5	23	30	7
	Total Funding	**2 037**	**2 432**	**2 674**	**242**

Table 14.3 – CTM – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	51	27	62
Indexed Conferences	44	46	82
Books			
Book Chapters		1	4
Concluded PhD Theses – Members	2	4	4
Concluded PhD Theses - Supervised	3	5	7

Table 14.4 – CTM – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)	7	1	4
Technology Disclosures (TDF)	2	1	1
First Priority Patent Applications (New Inventions)	2	1	1
First Patents Internationalisation		1	1
First Patent Granted	1		
Commercial Contracts (Licences, Options, Assignments)			
Spin-offs established			
Spin-offs in development			

Table 14.5 – CTM – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	8	6	4
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	5	5	4
International events in which INESC TEC members participate in the program committees	35	23	37
Participation in events such as fairs, exhibitions or similar	20	16	4
Conferences, workshops and scientific sessions organised by the Centre	7	11	4
Participants in the conferences, workshops and scientific sessions organised by the Centre	900	475	200
Advanced training courses organised by the Centre	2	2	2

Table 14.6 – CTM – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	MATinMOL	Maria Inês Carvalho	01/03/2021	28/02/2025
PN-FCT	TORIS	Luís Manuel Pessoa	01/03/2023	28/02/2025
PN-FCT	LUCCA	Tânia Pereira	01/03/2023	28/02/2025
PN-FCT	CELLO	Hélder Filipe Oliveira	06/03/2023	05/06/2026
PN-FCT	GEOSENSE-1	Henrique Salgado	01/01/2025	30/06/2026
PN-FCT	FALCON	Rui Lopes Campos	01/01/2025	30/06/2026
PN-FCT	AIMaCoV	Nuno Miguel Paulino	01/02/2025	31/07/2026
PN-COOP	STREAM	Luís Manuel Pessoa	01/01/2025	30/06/2027
PN-COOP	Produtech_R3-3	Rui Lopes Campos	01/09/2022	30/06/2026
PN-COOP	HfPT-3	Hélder Filipe Oliveira	01/10/2021	30/06/2026
PN-COOP	NewSpacePortugal-3	Ana Filipa Sequeira	01/10/2022	30/06/2026
PN-COOP	NEXUS-2	Filipe André Ribeiro	01/10/2022	30/06/2026
PN-COOP	SUSTAINABLE PLASTICS	Pedro Miguel Carvalho	01/09/2022	30/06/2026
PN-COOP	A-MoVeR	Luís Manuel Pessoa	01/12/2022	30/06/2026
PUE-DIV	AEROGANP-1	Hélder Martins Fontes	01/01/2023	30/06/2026
PUE-FP	CINDERELLA	Jaime Cardoso	01/06/2022	31/05/2026
PUE-FP	WATSON	Pedro Miguel Carvalho	01/03/2023	28/02/2026
PUE-FP	EADIGIFOLK	Gilberto Bernardes Almeida	01/01/2023	31/12/2026
PUE-FP	OVERWATCH-1	Hélder Martins Fontes	01/11/2022	30/04/2026
PUE-FP	CONVERGE	Luís Manuel Pessoa	01/02/2023	31/07/2026
PUE-FP	A-IQ Ready	João Canas Ferreira	01/01/2023	31/03/2026
PUE-FP	SuperIoT	Hélder Martins Fontes	01/01/2023	31/12/2025
PUE-FP	TERRAMETA	Luís Manuel Pessoa	01/01/2023	30/06/2026
PUE-FP	PHASE IV AI	Hélder Filipe Oliveira	01/10/2023	30/09/2026
PUE-FP	AI4LUNGS	Hélder Filipe Oliveira	01/01/2024	30/06/2027
PUE-FP	SEAGUARD-1	Rui Lopes Campos	01/10/2024	31/03/2027
PUE-FP	REPLICA	Hélder Martins Fontes	15/06/2024	15/03/2025
PUE-FP	HURRICANE	Hélder Martins Fontes	01/01/2025	31/12/2028
PUE-FP	MechEye	Nuno Alexandre Pereira	23/04/2025	22/10/2025
PUE-FP	INESCTEC.OCEAN-3	Rui Lopes Campos	01/01/2025	31/12/2030
SERV-NAC	STRx_Licenciamento	Filipe André Ribeiro	11/05/2020	31/01/2025
SERV-NAC	OPITDEV	Filipe André Ribeiro	01/01/2024	31/12/2025
SERV-NAC	TestBed5G_1	Rui Lopes Campos	01/02/2024	31/12/2025
SERV-NAC	5GCover	Filipe André Ribeiro	01/04/2025	31/12/2025
SERV-NAC	OGS-1	Henrique Salgado	01/09/2025	30/06/2026
OP	INVICTA2025	Ana Filipa Sequeira	01/04/2024	31/07/2025
OP	SLICESummerSchool25	Filipe Borges Teixeira	15/05/2025	14/07/2025

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

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14.2 CAP – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present CAP research team composition and evolution and the main indicators of its activity carried out in 2025 participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.7 – CAP – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	15,3	15,3	17,4	2,0
	R&D Employees	*3,5*	*3,6*	*2,3*	*-1,3*
	R&D Employees with PhD	*10,8*	*10,6*	*13,0*	*2,4*
	Mgmt, Admin. & Technical	*1,0*	*1,1*	*2,0*	*0,9*
	Faculty	9,9	9,1	8,1	-1,0
	Grant Holders	16,0	18,3	20,0	1,7
	Total Core HR	**41,2**	**42,7**	**45,4**	**2,7**

Table 14.8 – CAP – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT	113	40	131	91
PN-PICT	National R&D Programmes - S&T Integrated Projects		-5		5
PN-COOP	National Cooperation Programmes with Industry	287	469	1 079	610
PUE-FP	EU Framework Programmes	169	382	189	-193
PUE-DIV	EU Cooperation Programmes - Other	4	4	4	0
SERV-NAC	R&D Services and Consulting - National	5	72	41	-31
SERV-INT	R&D Services and Consulting - International	14		8	8
OP	Other Funding Programmes	89	109	418	308
	Total Funding	**680**	**1 071**	**1 868**	**797**

Table 14.9 – CAP – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	26	25	18
Indexed Conferences	15	27	25
Books			
Book Chapters			
Concluded PhD Theses – Members	2	3	2
Concluded PhD Theses - Supervised	2	3	2

Table 14.10 – CAP – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)	1	6	1
Technology Disclosures (TDF)	3	2	6
First Priority Patent Applications (New Inventions)	2	1	7
First Patents Internationalisation	2	1	1
First Patent Granted	4		2
Commercial Contracts (Licences, Options, Assignments)	1	1	
Spin-offs established		1	
Spin-offs in development	1	1	1

Table 14.11 – CAP – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	7	13	8
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	3	5	2
International events in which INESC TEC members participate in the program committees	8	1	5
Participation in events such as fairs, exhibitions or similar	2	3	1
Conferences, workshops and scientific sessions organised by the Centre	2	7	1
Participants in the conferences, workshops and scientific sessions organised by the Centre	200	160	600
Advanced training courses organised by the Centre	1		1

Table 14.12 – CAP – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	MYTAG	Pedro Jorge	01/01/2022	30/06/2025
PN-FCT	MODAS	Orlando Frazão	01/03/2023	28/02/2026
PN-FCT	OBSERVA-1	Orlando Frazão	01/04/2025	31/01/2026
PN-FCT	SPECTRA3D	Diana Filipa Guimarães	25/08/2025	24/02/2027
PN-COOP	LIBScan	Nuno Azevedo Silva	01/06/2024	31/05/2027
PN-COOP	AgendaTransform-1	Diana Filipa Guimarães	01/10/2022	30/06/2026
PN-COOP	ATE-1	Luís Carlos Coelho	01/01/2023	30/06/2026
PN-COOP	ATE_SOUND3D_OS-1	Orlando Frazão	01/07/2025	30/06/2026
PUE-FP	SUBMERSE	Orlando Frazão	01/05/2023	30/04/2026
PUE-FP	INNOAQUA-1	Luís Carlos Coelho	01/06/2023	31/05/2027
SERV-NAC	DFOSREN	Ireneu Dias	30/06/2021	31/12/2025
SERV-NAC	NovaLente	Manuel Joaquim Marques	19/12/2024	30/06/2025
SERV-INT	LIRA	Orlando Frazão	01/11/2021	31/03/2025
OP	SMARTCAP	Orlando Frazão	01/02/2022	31/01/2026
OP	OFS29	Paulo Vicente Marques	01/02/2023	31/01/2026

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

List of Publications

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2. Capela, D, Baptista, MC, Gomes, BM, Jorge, PAS, Silva, NA, Braga, MH, Guimaraes, D, "Laser-Induced Breakdown Spectroscopy for surface analysis of solid-state anode-less battery", JOURNAL OF POWER SOURCES, vol.647, pp.237328, 2025
3. Capela, D, Lopes, T, Dias, F, Ferreira, MFS, Teixeira, J, Lima, A, Jorge, PAS, Silva, NA, Guimaraes, D, "Advancing automated mineral identification through LIBS imaging for lithium-bearing mineral species", SPECTROCHIMICA ACTA PART B-ATOMIC SPECTROSCOPY, vol.223, pp.107085, JAN, 2025
4. Capela, D, Pessanha, S, Lopes, T, Cavaco, R, Teixeira, J, Ferreira, MFS, Magalhaes, P, Jorge, PAS, Silva, NA, Guimaraes, D, "From waste to resource: LIBS methodology development for rapid quality assessment of recycled wood", JOURNAL OF HAZARDOUS MATERIALS, vol.489, pp.137493, 2025
5. Cardoso, VHR, Caldas, P, Giraldi, MTR, Fernandes, CS, Frazao, O, Costa, JCWA, Santos, JL, "Design and testing of a probe for diameter variation measurement based on fiber Bragg grating combined with additive manufacturing", SENSORS AND ACTUATORS A-PHYSICAL, vol.391, pp.116604, 2025

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14. Piaia, V, MR, Robalinho, P, Silva, S, Frazão, O, "Fano Resonance of Fiber Bragg Grating for Liquid Sensing", Journal of Lightwave Technology, pp.1-7, 2025
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2. Almeida, MAS, Carvalho, JPM, Pastoriza-Santos, I, de Almeida, JMMM, Coelho, LCC, "Infrared Sensing Based on Tamm Plasmon Resonance for Hydrogen Detection", OPTICAL SENSORS 2025, vol.13527, pp.25, 2025

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11. Faria, R, Santos, AD, Da Silva, PM, Coelho, LCC, De Almeida, JMMM, Mendes, JP, "Temperature and relative humidity fiber optic sensing system for concrete monitoring", 29TH INTERNATIONAL CONFERENCE ON OPTICAL FIBER SENSORS, vol.13639, pp.417, 2025
12. Ferreira, TD, Monteiro, C, Gonçalves, C, Frazao, O, Silva, NA, "Enhancing a Polarimetric Fiber Sensor Using Fisher Information", 29TH INTERNATIONAL CONFERENCE ON OPTICAL FIBER SENSORS, vol.13639, pp.517, 2025
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20. Robalinho, P, Piaia, V, Ribeiro, AL, Silva, S, Frazao, O, "A New Perspective on the Optical Vernier Effect and Its Apparent Sensitivity Enhancement", 29TH INTERNATIONAL CONFERENCE ON OPTICAL FIBER SENSORS, vol.13639, pp.309, 2025
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24. van Golde, I, Silva, SO, Sousa, R, Pinto, P, Cândido, M, Frazão, O, "Application of Distributed Acoustic Sensing in Vessel Detection", EPJ Web of Conferences, vol.335, pp.03009, 2025
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Books

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Chapter/paper in Books

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Publications (Editor)

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1. Robalinho, P., "Advanced Fiber-Optic Devices for Harsh Environments Based on High-Power Wireless Energy Transfer and Novel Interferometric Architectures"
2. Viveiros, C., "Optical Fiber Sensors Fabricated by Femtosecond Laser Three-dimensional Micromachining"

14.3 CRAS – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present CRAS research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.13 – CRAS – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	30,6	34,4	40,3	5,9
	R&D Employees	*17,6*	*18,7*	*21,8*	*3,0*
	R&D Employees with PhD	*9,7*	*9,7*	*12,5*	*2,9*
	Mgmt, Admin. & Technical	*3,3*	*6,0*	*6,0*	*0,0*
	Faculty	11,7	11,1	11,6	0,5
	Grant Holders	39,3	38,9	44,7	5,8
	Total Core HR	**81,7**	**84,4**	**96,7**	**12,2**

Table 14.14 – CRAS – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT	566	570	626	56
PN-PICT	National R&D Programmes - S&T Integrated Projects				0
PN-COOP	National Cooperation Programmes with Industry	843	664	1 152	488
PUE-FP	EU Framework Programmes	1 769	1 892	2 791	899
PUE-DIV	EU Cooperation Programmes - Other	276	317	302	-15
SERV-NAC	R&D Services and Consulting - National	68	184	335	150
SERV-INT	R&D Services and Consulting - International	124	65	93	28
OP	Other Funding Programmes		3	84	81
	Total Funding	**3 646**	**3 695**	**5 382**	**1 687**

Table 14.15 – CRAS – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	25	23	21
Indexed Conferences	25	32	28
Books			
Book Chapters	2	5	4
Concluded PhD Theses – Members	1	5	2
Concluded PhD Theses - Supervised	1	5	2

Table 14.16 – CRAS – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)	2		1
Technology Disclosures (TDF)	1	3	2
First Priority Patent Applications (New Inventions)	1	2	1
First Patents Internationalisation	1	1	2
First Patent Granted	1		
Commercial Contracts (Licences, Options, Assignments)			
Spin-offs established			
Spin-offs in development			2

Table 14.17 – CRAS – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	7	8	10
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	2	5	5
International events in which INESC TEC members participate in the program committees	4	11	9
Participation in events such as fairs, exhibitions or similar	25	19	19
Conferences, workshops and scientific sessions organised by the Centre	12	24	32
Participants in the conferences, workshops and scientific sessions organised by the Centre	400	1 855	4 207
Advanced training courses organised by the Centre	3	4	4

Table 14.18 – CRAS – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	TEC4SEA	Eduardo Silva	01/09/2017	31/12/2022
PN-FCT	NMicroARTIC	Alfredo Martins	12/03/2023	11/03/2026
PN-FCT	SENTINEL	Ana Cristina Pires	01/01/2024	31/03/2025
PN-FCT	AI4PORTS	Nuno Cruz	15/01/2025	14/01/2026
PN-COOP	ADVISOR	André Dias	01/10/2024	30/09/2027
PN-COOP	DigiMaTRIA	André Dias	01/03/2025	15/02/2028
PN-COOP	Drivolution	André Dias	01/09/2022	30/06/2026
PN-COOP	StoneByPortugal	Ana Cristina Pires	01/07/2022	30/06/2026
PN-COOP	ATE_SEA_EYE	José Miguel Almeida	01/07/2025	30/06/2026
PN-COOP	ATE_INSPECT_OS	Nuno Cruz	01/07/2025	30/06/2026
PUE-DIV	SEAWINGS	José Miguel Almeida	01/12/2022	30/11/2026
PUE-DIV	AOWINDE	Ana Paula Lima	01/01/2023	30/03/2026
PUE-DIV	VICTORIOUS	Hugo Miguel Silva	07/04/2025	06/04/2028
PUE-DIV	BATTLEVERSE	Hugo Miguel Silva	01/11/2025	31/10/2028
PUE-DIV	UPWELLING	Ana Paula Lima	01/09/2025	31/12/2027
PUE-DIV	ATLAS	Nuno Cruz	01/10/2025	31/03/2028
PUE-FP	SPRING	Aníbal Matos	01/08/2019	31/07/2024
PUE-FP	ATLANTIS	Andry Maykol Pinto	01/01/2020	31/12/2023
PUE-FP	EUSCORES-3	José Miguel Almeida	01/09/2021	28/02/2027
PUE-FP	MAGPIE-2	Diana Viegas	01/10/2021	01/10/2026
PUE-FP	FIRELOGUE	Hugo Miguel Silva	01/11/2021	30/11/2025
PUE-FP	TRIDENT	José Miguel Almeida	01/01/2023	31/12/2027
PUE-FP	MineIO	José Miguel Almeida	01/01/2023	30/06/2026
PUE-FP	AIRSHIP	José Miguel Almeida	01/01/2023	31/12/2026
PUE-FP	TALOS	Andry Maykol Pinto	01/10/2023	30/09/2026
PUE-FP	NETTAGPlus	Diana Viegas	01/05/2023	30/04/2026
PUE-FP	NauticalSunrise	Alfredo Martins	01/12/2023	30/11/2027
PUE-FP	BioProtect	Alfredo Martins	01/05/2024	30/04/2028
PUE-FP	NuClim	Susana Alexandra Barbosa	01/09/2024	31/08/2028
PUE-FP	AEROSUB	Andry Maykol Pinto	01/12/2024	30/11/2028
SERV-NAC	UWRoboticEMFInspect	José Miguel Almeida	01/01/2024	31/12/2025
SERV-NAC	OPMAR1_EPISEA	Nuno Cruz	15/04/2025	14/05/2025
SERV-NAC	SERV_EX_UAV	Andry Maykol Pinto	14/03/2025	31/07/2026
SERV-NAC	Silos_Portos	José Miguel Almeida	15/03/2025	31/12/2025
SERV-NAC	OPMAR2_EPISEA	Nuno Cruz	06/05/2025	30/06/2025
SERV-NAC	BRI_AE_Project	Marcos Martins	02/05/2025	30/06/2025
SERV-NAC	OPMAR3_EPISEA	Nuno Cruz	13/05/2025	30/06/2025
SERV-NAC	MP_testesSensores	José Miguel Almeida	22/06/2025	30/06/2025
SERV-NAC	MP_Oceanografia	José Miguel Almeida	30/08/2025	31/12/2025
SERV-NAC	EVA_AMPA	José Miguel Almeida	04/10/2025	03/11/2025
SERV-INT	MP_LevantGeofisico	José Miguel Almeida	25/07/2025	31/12/2025
SERV-INT	ILVO2_eBAR	José Miguel Almeida	01/10/2023	31/12/2025
SERV-INT	SoleMATES	Alfredo Martins	01/03/2025	28/02/2027
OP	NAUTILUS	Nuno Cruz	01/07/2025	30/06/2028
OP	ROCOND	Paulo Santos	02/07/2025	30/09/2025
OP	M_MARS_MISSION	Bruno Fernandes	03/10/2025	30/11/2025
INT	SUMO_Mar_Profundo	Paulo Mónica Oliveira	01/01/2022	
INT	SUMO_Semi_Rig	Nuno Cruz	01/01/2022	

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

List of Publications

International Journals with Scientific Referees

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14.4 C-BER – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present C-BER research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.19 – C-BER – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	5,0	6,6	10,8	4,2
	R&D Employees	*2,0*	*2,3*	*5,3*	*3,0*
	R&D Employees with PhD	*2,0*	*3,3*	*4,5*	*1,2*
	Mgmt, Admin. & Technical	*1,0*	*1,0*	*1,0*	*0,0*
	Faculty	7,1	5,9	6,9	1,0
	Grant Holders	25,4	24,2	23,1	-1,1
	Total Core HR	**37,5**	**36,7**	**40,8**	**4,1**

Table 14.20 – C-BER – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT	99	61	93	32
PN-PICT	National R&D Programmes - S&T Integrated Projects				0
PN-COOP	National Cooperation Programmes with Industry	83	261	386	125
PUE-FP	EU Framework Programmes	98	152	290	138
PUE-DIV	EU Cooperation Programmes - Other				0
SERV-NAC	R&D Services and Consulting - National	10	62	32	-30
SERV-INT	R&D Services and Consulting - International	163	38	67	29
OP	Other Funding Programmes	7	12	12	0
	Total Funding	**460**	**586**	**879**	**293**

Table 14.21 – C-BER – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	23	24	21
Indexed Conferences	36	32	15
Books	1		
Book Chapters		1	1
Concluded PhD Theses – Members		2	3
Concluded PhD Theses - Supervised	2	2	4

Table 14.22 – C-BER – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)	1	8	3
Technology Disclosures (TDF)	1	1	7
First Priority Patent Applications (New Inventions)	1	2	2
First Patents Internationalisation	2	1	1
First Patent Granted	1	1	
Commercial Contracts (Licences, Options, Assignments)	1	1	1
Spin-offs established	1	1	
Spin-offs in development	1		

Table 14.23 – C-BER – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	6	2	7
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	7	3	5
International events in which INESC TEC members participate in the program committees	25	18	16
Participation in events such as fairs, exhibitions or similar	5	4	3
Conferences, workshops and scientific sessions organised by the Centre	3	3	4
Participants in the conferences, workshops and scientific sessions organised by the Centre	160	150	210
Advanced training courses organised by the Centre		1	1

Table 14.24 – C-BER – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	THOR	Miguel Coimbra	01/03/2021	28/02/2025
PN-FCT	CAGED	Miguel Coimbra	01/03/2021	28/02/2025
PN-FCT	EndoRadiomics	Maria Eduarda Almeida	01/03/2025	31/01/2026
PN-COOP	s2IO	Duarte Filipe Dias	01/01/2025	31/12/2027
PN-COOP	TEXPACT-1	Miguel Velhote Correia	01/07/2022	30/06/2026
PUE-FP	FIRE_RES-1	Duarte Filipe Dias	01/12/2021	30/11/2025
PUE-FP	CARE-IN-HEALTH	João Paulo Cunha	01/01/2023	31/12/2027
PUE-FP	AI4REALNET-1	Duarte Filipe Dias	01/10/2023	31/03/2027
SERV-NAC	EndoGastricAI	Miguel Coimbra	01/04/2024	31/03/2026
SERV-NAC	Agro_MTA	Duarte Filipe Dias	30/05/2025	29/12/2025
SERV-INT	RAISE	Duarte Filipe Dias	01/10/2022	31/12/2025
OP	smartDBS	João Paulo Cunha	01/12/2022	30/11/2025
OP	WeFetal	Duarte Filipe Dias	01/09/2025	31/07/2026

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

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14.5 CPES – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present CPES research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.25 – CPES – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	58,0	75,4	84,3	8,9
	R&D Employees	*40,4*	*53,6*	*59,9*	*6,3*
	R&D Employees with PhD	*16,3*	*19,5*	*21,4*	*1,8*
	Mgmt, Admin. & Technical	*1,3*	*2,3*	*3,0*	*0,7*
	Faculty	12,3	11,7	12,1	0,4
	Grant Holders	41,7	57,8	84,3	26,5
	Total Core HR	**111,9**	**144,9**	**180,7**	**35,8**

Table 14.26 – CPES – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT	84	77	81	5
PN-PICT	National R&D Programmes - S&T Integrated Projects	70	7		-7
PN-COOP	National Cooperation Programmes with Industry	1 083	3 176	4 414	1 239
PUE-FP	EU Framework Programmes	2 831	2 111	2 027	-84
PUE-DIV	EU Cooperation Programmes - Other	2	-1	11	11
SERV-NAC	R&D Services and Consulting - National	1 044	1 075	668	-407
SERV-INT	R&D Services and Consulting - International	168	243	372	128
OP	Other Funding Programmes	11		4	4
	Total Funding	**5 293**	**6 688**	**7 577**	**889**

Table 14.27 – CPES – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	52	66	46
Indexed Conferences	54	53	54
Books			
Book Chapters	3	1	3
Concluded PhD Theses – Members	4	1	4
Concluded PhD Theses - Supervised	4	5	5

Table 14.28 – CPES – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)	9	3	3
Technology Disclosures (TDF)	8	3	8
First Priority Patent Applications (New Inventions)	1	2	2
First Patents Internationalisation			1
First Patent Granted			
Commercial Contracts (Licences, Options, Assignments)		2	
Spin-offs established			
Spin-offs in development	1		

Table 14.29 – CPES – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	8	13	12
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	1	2	3
International events in which INESC TEC members participate in the program committees	3	4	8
Participation in events such as fairs, exhibitions or similar	3	13	20
Conferences, workshops and scientific sessions organised by the Centre	13	22	9
Participants in the conferences, workshops and scientific sessions organised by the Centre	745	2 187	740
Advanced training courses organised by the Centre	3	2	3

Table 14.30 – CPES – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	GENESIS-1	Tiago Manuel Campelos	02/07/2025	30/06/2028
PN-COOP	RN21	Zenaida Mourão	01/07/2022	30/06/2026
PN-COOP	BioShoes4All-1	Ricardo Jorge Bessa	01/07/2022	30/06/2026
PN-COOP	H2DRIVEN	Rui Esteves Araujo	01/10/2022	30/06/2026
PN-COOP	VINE_WINE_PT-1	Conceição Nunes Rocha	11/10/2022	30/06/2026
PN-COOP	NGS	Clara Sofia Gouveia	01/01/2023	30/06/2026
PN-COOP	Tools4AgriEnergy-LA11.1	José Villar	01/04/2023	31/12/2025
PUE-DIV	INSIEME	Ricardo Jorge Bessa	01/04/2025	31/03/2028
PUE-FP	XFLEX_HIDRO	Carlos Moreira	01/09/2019	29/02/2024
PUE-FP	InterConnect	David Emanuel Rua	01/10/2019	31/03/2024
PUE-FP	POCITYF	Justino Miguel Rodrigues	01/10/2019	30/09/2026
PUE-FP	EUniversal	Clara Sofia Gouveia	01/02/2020	30/11/2023
PUE-FP	OneNet	Alexandre Lucas	01/10/2020	31/03/2024
PUE-FP	ENERSHARE	Ricardo Jorge Bessa	01/07/2022	30/06/2025
PUE-FP	BeFlexible	Ricardo Jorge Bessa	01/09/2022	31/08/2026
PUE-FP	iSTENTORE	Filipe Joel Soares	01/01/2023	30/04/2026
PUE-FP	Green_Dat_AI	Gil Silva Sampaio	01/01/2023	31/12/2025
PUE-FP	SINNOGENES	Ricardo Silva	01/01/2023	31/12/2026
PUE-FP	Every1	Alexandre Lucas	01/11/2022	30/04/2026
PUE-FP	InterStore	Alexandre Lucas	01/01/2023	12/01/2026
PUE-FP	ENFIELD	Ricardo Jorge Bessa	01/09/2023	31/08/2026
PUE-FP	ENPOWER	José Villar	01/09/2023	31/08/2026
PUE-FP	TwinEU	João Peças Lopes	01/01/2024	31/12/2026
PUE-FP	SMHYLES	Helena Vasconcelos	01/01/2024	31/12/2027
PUE-FP	CRETE_VALLEY	Filipe Joel Soares	01/12/2023	30/11/2028
PUE-FP	EULAC ENERGYTRAN	Ignacio Gil	01/01/2024	31/12/2025
PUE-FP	HEDGE_IoT	Vasco Manuel Campos	01/01/2024	30/06/2027
PUE-FP	ORION	Tatiana Guedes	01/09/2024	31/08/2027
PUE-FP	AI_EFFECT	Ricardo Jorge Bessa	01/10/2024	30/09/2027
PUE-FP	HYNET	Justino Miguel Rodrigues	01/10/2024	30/09/2027
PUE-FP	EnerTEF	Alexandre Lucas	01/11/2024	31/10/2027
PUE-FP	STORHY	Bernardo Silva	01/10/2024	30/09/2028
PUE-FP	ECHO	Ricardo Jorge Bessa	01/12/2024	30/11/2028
PUE-FP	COSMIC	Alexandre Lucas	01/12/2024	30/11/2027
PUE-FP	SOLAR_MOVE	Tiago André Soares	01/11/2025	30/04/2029
PUE-FP	PVSmile	Tiago André Soares	01/11/2025	31/10/2028
SERV-NAC	MORADIST	Manuel Matos	01/02/2021	31/12/2025
SERV-NAC	Redes_GasRenov	João Peças Lopes	02/01/2021	30/06/2027
SERV-NAC	Fin_Losses	Filipe Joel Soares	01/10/2021	31/12/2025
SERV-NAC	ECOVALE	Zenaida Mourão	01/09/2022	31/12/2025
SERV-NAC	Eolica_offshorePT	João Peças Lopes	01/06/2023	31/03/2025
SERV-NAC	SmartAmmonia	Filipe Joel Soares	12/06/2023	31/12/2025
SERV-NAC	ConnectH2	Zenaida Mourão	03/07/2023	31/12/2025
SERV-NAC	RAM_PLAN_GREEN_PORT	João Peças Lopes	01/10/2023	30/06/2025
SERV-NAC	PVTerceira_EstComp	João Peças Lopes	22/11/2023	30/09/2024
SERV-NAC	SolarPV_Faial_EstCom	João Peças Lopes	22/11/2023	30/09/2024
SERV-NAC	PV_SJorge_Est	João Peças Lopes	27/12/2023	30/09/2024
SERV-NAC	DesCFoodScenarios	Zenaida Mourão	02/01/2024	30/09/2025

SERV-NAC	Perfis_Perdas_2025	José Nuno Fidalgo	20/05/2024	31/03/2025
SERV-NAC	EDALCOEGeotermicas	João Tomé Saraiva	01/07/2024	31/01/2025
SERV-NAC	I2P2024	José Nuno Fidalgo	15/05/2024	31/03/2025
SERV-NAC	EDALCOERenovaveis	João Tomé Saraiva	01/07/2024	31/12/2025
SERV-NAC	RECreation	José Villar	11/06/2024	10/06/2027
SERV-NAC	PROBONO	Zenaida Mourão	01/06/2024	30/09/2026
SERV-NAC	ELFOS_resampled	José Ricardo Andrade	01/09/2024	30/06/2025
SERV-NAC	HybridStorage	Ricardo Silva	01/09/2024	30/09/2025
SERV-NAC	Wind_Pico1_TA	Carlos Moreira	01/10/2024	30/06/2025
SERV-NAC	SERVSIS_VE	Filipe Joel Soares	01/10/2024	31/12/2025
SERV-NAC	CapRecep4NewRES	João Peças Lopes	01/10/2024	31/12/2025
SERV-NAC	Impacto_Invest	José Nuno Fidalgo	02/12/2024	31/12/2025
SERV-NAC	REATIVA_MINHO	João Azeredo Aguiar	01/12/2024	31/12/2025
SERV-NAC	RACp	José Nuno Fidalgo	06/01/2025	31/12/2025
SERV-NAC	CampusREN2025	João Peças Lopes	15/02/2025	14/04/2025
SERV-NAC	ImpacDinUPACs	Rui Sousa	01/04/2025	31/12/2025
SERV-NAC	Morgado_Arge_Statcom	Bernardo Silva	01/05/2025	31/12/2025
SERV-NAC	Hibrid_Douro	Bernardo Silva	01/04/2025	31/03/2026
SERV-NAC	Hibrid_Raia	Bernardo Silva	01/04/2025	31/03/2026
SERV-NAC	Perfis_Perdas_2026	José Nuno Fidalgo	15/05/2025	31/01/2026
SERV-NAC	PV_Alcoutim	Bernardo Silva	01/02/2025	31/12/2025
SERV-NAC	BorbaLosses	Filipe Joel Soares	25/07/2025	31/12/2025
SERV-NAC	FCR_HIDRICA	João Azeredo Aguiar	01/09/2025	30/11/2025
SERV-NAC	FPotBond	Rui Sousa	30/09/2025	27/02/2026
SERV-NAC	BLACK_START_EAU	Bernardo Silva	01/10/2025	31/05/2026
SERV-NAC	ParecerDLR	João Peças Lopes	15/12/2025	14/01/2026
SERV-NAC	BlackStartHydro	João Peças Lopes	15/12/2025	14/01/2026
SERV-NAC	EstudosGAT	Clara Sofia Gouveia	01/10/2025	30/06/2026
SERV-INT	CleanEnergy4EUIslands2	João Peças Lopes	15/04/2023	14/04/2027
SERV-INT	DynaMarket	José Villar	01/09/2024	31/08/2026
SERV-INT	PredicoSupport	José Ricardo Andrade	08/11/2024	07/04/2025
SERV-INT	JRCSIF-1	Vasco Manuel Campos	02/01/2025	30/06/2025
SERV-INT	PredicoSolar	José Ricardo Andrade	20/03/2025	19/05/2025
SERV-INT	PredicoSupportV2	José Ricardo Andrade	01/11/2025	31/01/2026
SERV-INT	GridNode	Clara Sofia Gouveia	26/06/2023	31/12/2025
SERV-INT	VRE_MZ	João Peças Lopes	02/01/2024	31/12/2025
SERV-INT	GridNode_Automation	Clara Sofia Gouveia	27/11/2024	31/12/2025
SERV-INT	Blackout	João Peças Lopes	15/05/2025	30/09/2025
SERV-INT	GridNode_Bridge	Clara Sofia Gouveia	01/09/2025	31/07/2026
SERV-INT	BlackoutAddendum	João Peças Lopes	18/07/2025	30/09/2025
OP	GREENSHIP_E	Tatiana Guedes	01/01/2025	31/12/2027

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

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2. Tavares, B., "Contributions of flexibility to operation and investment planning in distribution networks"

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4. Ribeiro, F., "Load-Frequency Control considering Hydrogen Electrolysers' response"

14.6 CESE – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present CESE research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.31 – CESE – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	29,5	31,8	31,4	-0,4
	R&D Employees	*18,3*	*19,2*	*18,6*	*-0,7*
	R&D Employees with PhD	*9,2*	*10,5*	*10,8*	*0,3*
	Mgmt, Admin. & Technical	*2,0*	*2,0*	*2,0*	*0,0*
	Faculty	15,7	14,9	15,3	0,4
	Grant Holders	13,8	17,6	20,6	3,0
	Total Core HR	**59,0**	**64,3**	**67,3**	**3,0**

Table 14.32 – CESE – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT	21	-1	10	11
PN-PICT	National R&D Programmes - S&T Integrated Projects				0
PN-COOP	National Cooperation Programmes with Industry	1 367	1 315	1463	149
PUE-FP	EU Framework Programmes	550	618	617	-1
PUE-DIV	EU Cooperation Programmes - Other	-1	4	2	-3
SERV-NAC	R&D Services and Consulting - National	225	139	230	91
SERV-INT	R&D Services and Consulting - International	64	20	13	-7
OP	Other Funding Programmes	2	68	51	-17
	Total Funding	**2 227**	**2 163**	**2 387**	**224**

Table 14.33 – CESE – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	33	33	22
Indexed Conferences	33	35	30
Books	1	1	1
Book Chapters	2	4	7
Concluded PhD Theses – Members	2		
Concluded PhD Theses - Supervised	2		

Table 14.34 – CESE – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)	2	14	2
Technology Disclosures (TDF)	3	2	4
First Priority Patent Applications (New Inventions)			2
First Patents Internationalisation			
First Patent Granted			
Commercial Contracts (Licences, Options, Assignments)			
Spin-offs established			
Spin-offs in development		2	1

Table 14.35 – CESE – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	3	8	8
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	1	3	3
International events in which INESC TEC members participate in the program committees	8	11	16
Participation in events such as fairs, exhibitions or similar	5	14	4
Conferences, workshops and scientific sessions organised by the Centre	8	5	4
Participants in the conferences, workshops and scientific sessions organised by the Centre	190	289	345
Advanced training courses organised by the Centre	1	3	2

Table 14.36 – CESE – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	LOGin	Tânia Daniela Fontes	01/10/2025	29/09/2028
PN-COOP	WOOSU	António Baptista	01/04/2025	31/03/2028
PN-COOP	GrapeUP	António Baptista	01/05/2025	30/04/2028
PN-COOP	BE@T-1	César Toscano	01/07/2022	30/06/2026
PN-COOP	Hi_reV-1	Rui Diogo Rebelo	01/01/2022	30/06/2026
PN-COOP	GIATEX	Rui Correia Dias	01/10/2022	30/06/2026
PN-COOP	Blue_Bioeconomy	Rui Correia Dias	01/01/2023	30/06/2026
PN-COOP	BLOCKCHAINPT	Luís Guardão	01/01/2023	30/06/2026
PN-COOP	FAIST-2	Rui Diogo Rebelo	01/06/2022	30/06/2026
PUE-DIV	BIOTECFOR-1	Alexandra Sofia Marques	01/01/2017	31/12/2020
PUE-DIV	MANUFACTUR4.0-1	Ana Cristina Barros	17/04/2017	31/12/2020
PUE-FP	CircThread	António Lucas Soares	01/06/2021	31/05/2025
PUE-FP	SoTecInFactory	Gustavo Dalmarco	01/06/2022	31/05/2025
PUE-FP	ReSChape	Ricardo Augusto Zimmermann	01/10/2022	30/09/2025
PUE-FP	tExtended	César Toscano	01/12/2022	30/11/2026
PUE-FP	RISESME	Ricardo Augusto Zimmermann	01/01/2024	31/12/2026
PUE-FP	RENEE-1	António Baptista	01/01/2024	31/12/2027
PUE-FP	EITM_RIS_Hubs_2024	Vasco Bernardo Teles	01/01/2024	31/12/2025
PUE-FP	TTAccelerator	Vasco Bernardo Teles	01/01/2024	31/12/2025
SERV-NAC	MESPARTNERSHIP	Luís Guardão	25/11/2020	25/01/2026
SERV-NAC	APSPARTNERSHIP	Luís Guardão	15/11/2020	15/01/2026
SERV-NAC	ECOSSISTEMA	Rui Diogo Rebelo	28/02/2022	31/03/2025
SERV-NAC	DTNARR3AUTO	Filipe David Ferreira	25/09/2023	31/03/2025
SERV-NAC	DesCFoodRoteiro2050-1	Rui Diogo Rebelo	02/01/2024	31/12/2025
SERV-NAC	DesCFoodTec2050-1	Rui Diogo Rebelo	01/02/2024	30/09/2025
SERV-NAC	OutsourcingIT_Fase1	Hugo Miguel Ferreira	16/09/2024	28/02/2025
SERV-NAC	DTACCMES24	Filipe David Ferreira	01/11/2024	30/06/2026
SERV-NAC	SustainableTestBed	Carla Pereira	25/10/2024	31/05/2026
SERV-NAC	SIM_AMRs	Henrique Piqueiro	02/01/2025	30/06/2025
SERV-NAC	PFFSCHED	Luís Guardão	01/02/2025	31/10/2026
SERV-NAC	DT_FSM_DIAG	António Correia Alves	17/03/2025	30/06/2025
SERV-NAC	ARQUITETURA_ITOT	António Lucas Soares	01/05/2025	31/12/2025
SERV-NAC	PFAI4_6eD	Grasiela Almeida	01/04/2025	30/09/2025
SERV-NAC	DTVIA	António Correia Alves	08/09/2025	09/12/2025
SERV-NAC	PFA_DIG_SHOPFLOOR_2a	Rui Diogo Rebelo	16/10/2025	30/12/2025
SERV-INT	BeamAutoLogSim	Romão Filipe Santos	01/11/2023	31/12/2025
OP	PROVE2025	Marta Oliveira	03/05/2025	02/02/2026

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

List of publications

International Journals with Scientific Referees

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14.7 CRIIS – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present CRIIS research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.37 – CRIIS – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	23,9	30,9	33,3	2,4
	R&D Employees	*13,4*	*16,8*	*15,9*	*-1,0*
	R&D Employees with PhD	*8,1*	*11,0*	*14,1*	*3,1*
	Mgmt, Admin. & Technical	*2,3*	*3,0*	*3,3*	*0,3*
	Faculty	14,6	14,7	17,3	2,6
	Grant Holders	35,4	44,8	44,6	-0,2
	Total Core HR	**73,9**	**90,4**	**95,1**	**4,8**

Table 14.38 – CRIIS – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT	19	26	54	28
PN-PICT	National R&D Programmes - S&T Integrated Projects				0
PN-COOP	National Cooperation Programmes with Industry	1 416	2 114	2 511	397
PUE-FP	EU Framework Programmes	875	732	502	-230
PUE-DIV	EU Cooperation Programmes - Other	-1		30	30
SERV-NAC	R&D Services and Consulting - National	177	81	136	55
SERV-INT	R&D Services and Consulting - International	9	16	20	4
OP	Other Funding Programmes	6	11		-11
	Total Funding	**2 500**	**2 979**	**3 253**	**274**

Table 14.39 – CRIIS – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	46	57	57
Indexed Conferences	46	70	30
Books			
Book Chapters	4	5	5
Concluded PhD Theses – Members	2	4	6
Concluded PhD Theses - Supervised	2	11	11

Table 14.40 – CRIIS – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)	4	5	3
Technology Disclosures (TDF)	2		8
First Priority Patent Applications (New Inventions)	1		1
First Patents Internationalisation		1	
First Patent Granted	1		1
Commercial Contracts (Licences, Options, Assignments)			
Spin-offs established			
Spin-offs in development	1	3	3

Table 14.41 – CRIIS – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	2	7	9
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	3	4	4
International events in which INESC TEC members participate in the program committees	11	14	9
Participation in events such as fairs, exhibitions or similar	10	11	14
Conferences, workshops and scientific sessions organised by the Centre	2	4	4
Participants in the conferences, workshops and scientific sessions organised by the Centre	250	90	140
Advanced training courses organised by the Centre			

Table 14.42 – CRIIS – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	OmicBots	Mário Cunha	16/01/2022	15/01/2026
PN-COOP	InsectERA	Filipe Neves Santos	01/01/2023	30/06/2026
PN-COOP	GreenAuto	Manuel Santos Silva	03/10/2022	30/06/2026
PN-COOP	PhenoBot-LA8.1-1	Filipe Neves Santos	01/10/2022	31/12/2025
PN-COOP	Wine4Cast-LA8.1	Filipe Neves Santos	01/10/2022	31/12/2025
PUE-FP	AgRoBoFood	Filipe Neves Santos	01/06/2019	29/02/2024
PUE-FP	MARI4_YARD	Germano Veiga	01/12/2020	30/11/2024
PUE-FP	Waste2BioComp	Germano Veiga	01/06/2022	31/05/2025
PUE-FP	PEER-1	Rafael Lírio Arrais	01/10/2023	30/09/2027
PUE-FP	iBot4CRMs	Luís Freitas Rocha	01/12/2024	30/11/2028
PUE-FP	AGROBOOST-1	Filipe Neves Santos	01/11/2025	31/10/2030
SERV-NAC	Estaleiro40-1	Filipe Neves Santos	01/05/2023	30/09/2025
SERV-NAC	RLSENSEDEMO	Filipe Neves Santos	01/06/2024	31/10/2025
SERV-NAC	sensewater	Filipe Neves Santos	01/11/2024	31/12/2025
SERV-NAC	TestBed5G_2	Manuel Santos Silva	01/02/2024	31/03/2025
SERV-NAC	MacSense	Luís Freitas Rocha	03/02/2025	31/12/2025
SERV-NAC	LTDSupport	Manuel Santos Silva	01/04/2025	31/12/2025
SERV-NAC	LOCPLANT	Daniel Queirós Silva	01/05/2025	31/03/2026
SERV-NAC	RAPID_Start	Héber Miguel Sobreira	01/07/2025	31/12/2025
SERV-NAC	VineShieldDT	Filipe Neves Santos	01/07/2025	31/03/2026
SERV-NAC	TestBed5G_Robotics	Roberto Magalhães Silva	01/09/2025	30/11/2025
SERV-NAC	ModularXCEMTEX	Filipe Neves Santos	12/09/2025	11/03/2026
SERV-INT	BIOFAB-1	Luís Freitas Rocha	01/06/2025	31/12/2025

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

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2. Cordeiro, A., "Configurable Perception Pipeline for Bin-picking in Industrial Scenarios"
3. Tinoco, V., "Design and Control of Cost-Effective Agricultural Robotic Manipulators"
4. Safaee, A., "Design and Development of a Fixed-Wing Tail-Sitter Tethered VTOL Drone with Custom Autopilot and Robust Control Techniques"
5. Sarmento, J., "Safe Human-Robot Interaction and Coexistence in Agriculture"
6. Matos, D., "Supervisioning and Schedulling Optimisations in Multi AMRs Systems"

14.8 CEGI – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present CEGI research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.43 – CEGI – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	11,1	12,5	11,7	-0,8
	R&D Employees	*2,3*	*4,3*	*3,7*	*-0,6*
	R&D Employees with PhD	*7,7*	*7,2*	*7,0*	*-0,2*
	Mgmt, Admin. & Technical	*1,0*	*1,0*	*1,0*	*0,0*
	Faculty	24,6	23,5	28,3	4,8
	Grant Holders	24,8	33,4	36,5	3,1
	Total Core HR	**60,5**	**69,3**	**76,5**	**7,1**

Table 14.44 – CEGI – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT	165	207	95	-111
PN-PICT	National R&D Programmes - S&T Integrated Projects				0
PN-COOP	National Cooperation Programmes with Industry	239	434	644	210
PUE-FP	EU Framework Programmes	512	441	383	-58
PUE-DIV	EU Cooperation Programmes - Other		-4		4
SERV-NAC	R&D Services and Consulting - National	35	10	112	102
SERV-INT	R&D Services and Consulting - International				0
OP	Other Funding Programmes	-2			0
	Total Funding	**949**	**1 088**	**1 234**	**146**

Table 14.45 – CEGI – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	61	52	52
Indexed Conferences	15	20	6
Books		1	
Book Chapters	5	2	1
Concluded PhD Theses – Members	1	6	3
Concluded PhD Theses - Supervised	2	6	3

Table 14.46 – CEGI – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)		1	8
Technology Disclosures (TDF)	1	1	2
First Priority Patent Applications (New Inventions)		1	
First Patents Internationalisation			1
First Patent Granted			
Commercial Contracts (Licences, Options, Assignments)		2	
Spin-offs established			1
Spin-offs in development	2	3	1

Table 14.47 – CEGI – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	27	18	5
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	5	1	5
International events in which INESC TEC members participate in the program committees	12	14	
Participation in events such as fairs, exhibitions or similar	1	6	2
Conferences, workshops and scientific sessions organised by the Centre		3	2
Participants in the conferences, workshops and scientific sessions organised by the Centre		100	74
Advanced training courses organised by the Centre		1	

Table 14.48 – CEGI – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	BeFresh	Pedro Amorim	01/01/2022	04/10/2025
PN-FCT	CIBELE	José Fernando Oliveira	01/03/2023	28/02/2025
PN-FCT	TacitRouting	António Galrão Ramos	01/03/2023	25/02/2025
PN-FCT	eduBEST	Ana Camanho	01/02/2023	31/10/2026
PN-FCT	AIOTacitR	Farzam Salimi	09/10/2025	07/10/2028
PN-COOP	SMARTgNOSTICS	Luís Guimarães	01/01/2023	30/06/2026
PUE-FP	TRUSTAI	Gonçalo Reis Figueira	01/10/2020	31/03/2025
PUE-FP	DECODIT	Lia Patrício	01/06/2024	30/11/2027
SERV-NAC	CAREVIEW	Mário Amorim Lopes	01/06/2023	31/12/2025
SERV-NAC	ChurnManagement	Fábio Silva Moreira	01/01/2025	31/12/2027
SERV-NAC	WScheduleAI	Vera Miguéis	01/01/2025	31/12/2026
SERV-NAC	GenAI4Impact	António Henrique Almeida	24/09/2025	23/10/2025

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

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7. Andrade, BPB, Andrade, ACB, Lacerda, DP, Piran, FAS, "Analysis of methods to transform existing buildings into Nearly Zero Energy Buildings (NZEB)", SOLAR ENERGY, 2025
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14.9 CITE – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present CITE research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.49 – CITE – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	6,2	6,1	6,7	0,6
	R&D Employees	*2,6*	*3,0*	*3,7*	*0,7*
	R&D Employees with PhD	*3,6*	*3,1*	*3,0*	*-0,1*
	Mgmt, Admin. & Technical	*0,0*	*0,0*	*0,0*	*0,0*
	Faculty	4,0	4,1	4,4	0,4
	Grant Holders	1,2	1,7	3,4	1,7
	Total Core HR	**11,4**	**11,9**	**14,5**	**2,6**

Table 14.50 – CITE – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT				0
PN-PICT	National R&D Programmes - S&T Integrated Projects				0
PN-COOP	National Cooperation Programmes with Industry	126	217	216	-1
PUE-FP	EU Framework Programmes	212	192	377	186
PUE-DIV	EU Cooperation Programmes - Other	54	19	57	38
SERV-NAC	R&D Services and Consulting - National	2	1		-1
SERV-INT	R&D Services and Consulting - International	28			0
OP	Other Funding Programmes		-4		4
	Total Funding	**422**	**425**	**650**	**225**

Table 14.51 – CITE – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	22	21	12
Indexed Conferences	1	2	1
Books			5
Book Chapters	4	4	
Concluded PhD Theses – Members			
Concluded PhD Theses - Supervised			2

Table 14.52 – CITE – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)			
Technology Disclosures (TDF)			
First Priority Patent Applications (New Inventions)			
First Patents Internationalisation			
First Patent Granted			
Commercial Contracts (Licences, Options, Assignments)			
Spin-offs established			
Spin-offs in development			

Table 14.53 – CITE – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	1	1	5
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	2	3	1
International events in which INESC TEC members participate in the program committees	2	4	1
Participation in events such as fairs, exhibitions or similar	4	3	4
Conferences, workshops and scientific sessions organised by the Centre	12	7	5
Participants in the conferences, workshops and scientific sessions organised by the Centre	120	80	100
Advanced training courses organised by the Centre			

Table 14.54 – CITE – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PUE-DIV	EEN2022	Alexandra Xavier	01/01/2022	30/06/2025
PUE-DIV	EEN2028	Cristina Maria Barbosa	01/07/2025	31/12/2028
PUE-FP	VR2Care-1	Cristina Machado Guimarães	01/01/2022	30/06/2024
PUE-FP	MANTRA	Alexandra Xavier	01/11/2024	30/04/2028

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

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1. Guimaraes, CM, Amorim, V, Almeida, F, "Responsible Research and Innovation (RRI) Assessment: The Path to a Tool", HUMAN-CENTRED TECHNOLOGY MANAGEMENT FOR A SUSTAINABLE FUTURE, VOL 3, IAMOT 2024, pp.511-519, 2025

Books

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Chapter/Paper in Books

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2. Almeida, FL, FLF, Lucas, F, Oliveira, C, "The role of derivatives in machine learning: Optimisation, applications and ethical considerations for the education field", Advances in Computational Intelligence and Robotics - AI Applications and Pedagogical Innovation, pp.307-331, 2025
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Publications (Editor)

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Concluded Theses (PhD)

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14.10 HUMANISE – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present HumanISE research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.55 – HumanISE – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	17,7	20,7	24,5	3,8
	R&D Employees	*14,2*	*15,2*	*15,0*	*-0,2*
	R&D Employees with PhD	*2,5*	*4,4*	*7,8*	*3,3*
	Mgmt, Admin. & Technical	*1,0*	*1,0*	*1,7*	*0,7*
	Faculty	53,6	61,5	58,2	-3,3
	Grant Holders	36,0	35,6	53,2	17,6
	Total Core HR	**107,3**	**117,8**	**135,8**	**18,1**

Table 14.56 – HumanISE – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT	59	51	87	36
PN-PICT	National R&D Programmes - S&T Integrated Projects				0
PN-COOP	National Cooperation Programmes with Industry	701	810	1 339	529
PUE-FP	EU Framework Programmes	623	716	1 098	381
PUE-DIV	EU Cooperation Programmes - Other	147	89	43	-46
SERV-NAC	R&D Services and Consulting - National	470	545	460	-85
SERV-INT	R&D Services and Consulting - International			5	5
OP	Other Funding Programmes				0
	Total Funding	**2 001**	**2 211**	**3 031**	**820**

Table 14.57 – HumanISE – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	90	72	76
Indexed Conferences	85	109	109
Books	1	2	1
Book Chapters	1		13
Concluded PhD Theses – Members	4	10	8
Concluded PhD Theses - Supervised	8	26	12

Table 14.58 – HumanISE – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)	4		1
Technology Disclosures (TDF)			1
First Priority Patent Applications (New Inventions)			1
First Patents Internationalisation			
First Patent Granted	1		
Commercial Contracts (Licences, Options, Assignments)	1		
Spin-offs established			
Spin-offs in development			

Table 14.59 – HumanISE – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	3	1	13
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	12	6	19
International events in which INESC TEC members participate in the program committees	37	29	73
Participation in events such as fairs, exhibitions or similar	7		43
Conferences, workshops and scientific sessions organised by the Centre			8
Participants in the conferences, workshops and scientific sessions organised by the Centre			86
Advanced training courses organised by the Centre			9

Table 14.60 – HumanISE - List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	DBoidS	João Barroso	01/01/2022	30/06/2025
PN-FCT	UNIFY-1	João Bispo	10/03/2023	09/03/2026
PN-FCT	IATriage4SU	Frederico Branco	01/04/2025	31/01/2026
PN-FCT	DUVOPS	João Barroso	01/07/2025	29/06/2028
PN-COOP	XARPER_RETAIL	Nelson Bilber Rodrigues	01/05/2025	30/04/2027
PN-COOP	IATOS	Hugo Paredes	01/10/2025	29/09/2028
PUE-DIV	MarRisk	Artur Rocha	01/07/2017	30/06/2021
PUE-DIV	RADARONRAIA	Lino Oliveira	01/01/2018	31/07/2022
PUE-DIV	TRIO	Maria van Zeller	28/02/2022	27/07/2024
PUE-DIV	CAPTA	Lino Oliveira	01/07/2023	31/12/2026
PUE-DIV	POEMS	Luis Miguel Pinho	01/03/2025	28/02/2029
PUE-FP	EUCAN_CONNECT	Gonçalo Campos Gonçalves	01/01/2019	31/12/2023
PUE-FP	INCLUDING	Miguel Correia Melo	01/08/2019	31/07/2024
PUE-FP	Inno4Vac	Artur Rocha	01/09/2021	28/02/2027
PUE-FP	ILIAD	Artur Rocha	01/02/2022	31/07/2025
PUE-FP	RECONNECTED	Gonçalo Campos Gonçalves	01/06/2023	30/11/2027
PUE-FP	BLUE-X	Marco Amaro Oliveira	01/12/2023	31/05/2026
PUE-FP	NOUS	Hugo Paredes	01/01/2024	31/12/2026
PUE-FP	FRODDO	Hugo Paredes	01/06/2024	31/05/2027
PUE-FP	IMPROVE_PRETERM	Artur Rocha	01/01/2025	31/12/2028
PUE-FP	DARE	Luis Miguel Pinho	01/03/2025	31/12/2027
SERV-NAC	PalacioDaAgua	José Luís Martins	01/06/2018	31/12/2025
SERV-NAC	MAP3	José Correia	15/09/2022	30/09/2025
SERV-NAC	EYEFRYBluetooth	José Correia	02/09/2024	31/12/2025
SERV-NAC	FJB	Sérgio Nunes	19/03/2024	31/12/2025
SERV-NAC	BankTransf24	José Correia	21/06/2024	20/02/2025
SERV-NAC	BankRoad2DataMgm	José Correia	29/07/2024	31/05/2026
SERV-NAC	AMIDA	Ângelo Martins	25/07/2024	30/09/2025
SERV-NAC	DevSecPaaS	Lino Oliveira	01/10/2024	30/06/2026
SERV-NAC	eVoteTecTransf	José Correia	15/11/2024	31/07/2026
SERV-NAC	PGU2CIMTS	José Correia	01/04/2025	31/03/2026
SERV-NAC	PGU2CIMTTM	José Correia	28/07/2025	31/03/2026
SERV-NAC	JVisualEditorAI	Ademar Aguiar	01/10/2024	31/07/2026
SERV-INT	CTEV360	Maria van Zeller	06/05/2025	31/12/2025

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

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14.11 LIAAD – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present LIAAD research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.61 – LIAAD – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	10,1	12,2	16,0	3,9
	R&D Employees	*3,2*	*4,9*	*6,6*	*1,7*
	R&D Employees with PhD	*5,9*	*6,3*	*8,4*	*2,2*
	Mgmt, Admin. & Technical	*1,0*	*1,0*	*1,0*	*0,0*
	Faculty	29,8	31,7	31,1	-0,6
	Grant Holders	25,5	20,8	21,8	1,0
	Total Core HR	**65,4**	**64,7**	**69,0**	**4,3**

Table 14.62 – LIAAD – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT	96	95	241	147
PN-PICT	National R&D Programmes - S&T Integrated Projects				0
PN-COOP	National Cooperation Programmes with Industry	314	392	439	47
PUE-FP	EU Framework Programmes	106	257	217	-41
PUE-DIV	EU Cooperation Programmes - Other	16	-61		61
SERV-NAC	R&D Services and Consulting - National	63	54	160	106
SERV-INT	R&D Services and Consulting - International		65	35	-30
OP	Other Funding Programmes	14		160	160
	Total Funding	**608**	**802**	**1 252**	**450**

Table 14.63 – LIAAD – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	60	54	63
Indexed Conferences	58	36	46
Books	2		
Book Chapters	8	2	5
Concluded PhD Theses – Members	2	4	4
Concluded PhD Theses - Supervised	7	6	8

Table 14.64 – LIAAD – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)	1		3
Technology Disclosures (TDF)	1	2	1
First Priority Patent Applications (New Inventions)	1	1	1
First Patents Internationalisation		1	1
First Patent Granted			
Commercial Contracts (Licences, Options, Assignments)	1		
Spin-offs established			
Spin-offs in development		1	

Table 14.65 – LIAAD – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	20	20	9
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	8	9	7
International events in which INESC TEC members participate in the program committees	45	36	21
Participation in events such as fairs, exhibitions or similar	4	10	3
Conferences, workshops and scientific sessions organised by the Centre	6	4	3
Participants in the conferences, workshops and scientific sessions organised by the Centre	300	100	1 450
Advanced training courses organised by the Centre		1	

Table 14.66 – LIAAD – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	ADANET	Alípio Jorge	17/05/2022	15/01/2026
PN-FCT	StorySense	Alípio Jorge	01/03/2023	28/02/2026
PN-FCT	TSP2Net-1	Maria Eduarda Silva	01/02/2025	31/07/2026
PN-FCT	CitiLink	Ricardo Campos	01/04/2025	31/01/2026
PN-FCT	EnSafe	João Gama	01/03/2025	31/01/2026
PN-FCT	FOXPM	Rita Paula Ribeiro	16/09/2025	14/09/2028
PN-COOP	ScopeAI	Ricardo Teixeira Sousa	01/09/2025	31/08/2028
PUE-FP	EMERITUS	João Gama	01/09/2022	31/08/2025
PUE-FP	AIBOOST	João Gama	01/09/2023	28/02/2027
PUE-FP	GREENGROCER	Alípio Jorge	01/09/2025	31/08/2029
SERV-NAC	Easy4ALL	Evelin Freire Amorim	01/09/2024	31/08/2026
SERV-NAC	PROD_AI	Ricardo Teixeira Sousa	01/05/2025	01/09/2027
SERV-NAC	NEIS	João Gama	17/02/2025	31/03/2026
SERV-NAC	ATAI	Ricardo Teixeira Sousa	01/07/2025	31/08/2027
SERV-INT	Doc2FraudDetection	João Gama	10/02/2025	30/06/2025
OP	ECML_PKDD2025	João Gama	15/09/2025	19/09/2026

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

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3. Neves, T., "Generative models for soccer"
4. Ribeiro, P., "Inmplode: A Framework to Interpret Multiple Related Rule-Based Models"

14.12 CRACS – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present CRACS research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.67 – CRACS – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	1,3	2,0	1,2	-0,8
	R&D Employees	*1,0*	*1,0*	*1,0*	*0,0*
	R&D Employees with PhD	*0,3*	*1,0*	*0,2*	*-0,8*
	Mgmt, Admin. & Technical	*0,0*	*0,0*	*0,0*	*0,0*
	Faculty	17,2	16,5	16,8	0,3
	Grant Holders	10,7	12,1	12,1	0,0
	Total Core HR	**29,2**	**30,6**	**30,1**	**-0,5**

Table 14.68 – CRACS – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT		-3	31	34
PN-PICT	National R&D Programmes - S&T Integrated Projects				0
PN-COOP	National Cooperation Programmes with Industry	19	94	96	2
PUE-FP	EU Framework Programmes	84	79	88	9
PUE-DIV	EU Cooperation Programmes - Other	34	20	28	8
SERV-NAC	R&D Services and Consulting - National	93			0
SERV-INT	R&D Services and Consulting - International				0
OP	Other Funding Programmes		20	1	-20
	Total Funding	**230**	**210**	**243**	**33**

Table 14.69 – CRACS – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	15	13	24
Indexed Conferences	25	21	17
Books	2		
Book Chapters	3	3	1
Concluded PhD Theses – Members	3	1	2
Concluded PhD Theses - Supervised	4	2	2

Table 14.70 – CRACS – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)			1
Technology Disclosures (TDF)			
First Priority Patent Applications (New Inventions)			
First Patents Internationalisation			
First Patent Granted	1		
Commercial Contracts (Licences, Options, Assignments)			
Spin-offs established			
Spin-offs in development			

Table 14.71 – CRACS – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	10	7	8
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	15	5	3
International events in which INESC TEC members participate in the program committees	34	31	23
Participation in events such as fairs, exhibitions or similar	2	2	2
Conferences, workshops and scientific sessions organised by the Centre		1	3
Participants in the conferences, workshops and scientific sessions organised by the Centre		80	130
Advanced training courses organised by the Centre		4	

Table 14.72 – CRACS – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	HOSKY	João Soares Resende	01/05/2025	31/01/2026
PUE-DIV	FGPEPlusPlus	Ricardo Queirós	01/10/2023	30/09/2025
PUE-FP	PRIVATEER	António Pinto	01/01/2023	31/12/2025

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

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12. Moreno, P, Areias, M, Rocha, R, "A sleek lock-free hash map in an ERA of safe memory reclamation methods", PARALLEL COMPUTING, vol.126, pp.103162, NOV, 2025
13. Mukhandi, M, Granjal, J, Vilela, JP, "Blockchain hybrid-model scheme for scalable cross-domain authorisation", BLOCKCHAIN-RESEARCH AND APPLICATIONS, vol.6, no.4, pp.100293, DEC, 2025

14. Paiva, JC, Leal, JP, Figueira, A, "Clustering source code from automated assessment of programming assignments", INTERNATIONAL JOURNAL OF DATA SCIENCE AND ANALYTICS, vol.20, no.2, pp.1581-1592, 2025

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2. Bauer, Y, Leal, JP, Queirós, R, Swacha, J, Paiva, JC, "Designing a Multi-Narrative Gamified Learning Experience", ICPEC, pp.15:1-15:8, 2025

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2. Cunha, M., "Privacy-Preserving Mechanisms for Heterogeneous Data Types"

14.13 HASLAB – ACTIVITY RESULTS IN 2025

Activity indicators

The following tables present HASLab research team composition and evolution and the main indicators of its activity carried out in 2025 - participation in projects under contract, scientific production, IP valorisation and knowledge dissemination. The information on publications for 2025 has been obtained from different indexing sources (ISI, SCOPUS and DBLP) gathered by the Authenticus platform and from CORE (Computing Research and Education Association of Australasia).

Table 14.73 – HASLab – Research team composition

	Type of Human Resources	2023	2024	2025	Δ 2024-25
Core HR	Employees	13,5	15,5	17,5	2,0
	R&D Employees	*3,8*	*6,0*	*7,1*	*1,1*
	R&D Employees with PhD	*5,0*	*5,5*	*5,8*	*0,3*
	Mgmt, Admin. & Technical	*4,7*	*4,0*	*4,6*	*0,6*
	Faculty	30,2	31,0	29,9	-1,1
	Grant Holders	48,0	48,4	50,7	2,4
	Total Core HR	**91,7**	**94,9**	**98,1**	**3,3**

Table 14.74 – HASLab – Project funding

Funding Source		Total Income (k€)			Δ (k€)
		2023	2024	2025	2024-25
PN-FCT	National R&D Programmes - FCT	106	78	87	8
PN-PICT	National R&D Programmes - S&T Integrated Projects				0
PN-COOP	National Cooperation Programmes with Industry	357	459	741	282
PUE-FP	EU Framework Programmes	370	367	171	-196
PUE-DIV	EU Cooperation Programmes - Other	27	119	173	55
SERV-NAC	R&D Services and Consulting - National	269	256	263	7
SERV-INT	R&D Services and Consulting - International	5		18	18
OP	Other Funding Programmes	193	257	155	-102
	Total Funding	**1 326**	**1 537**	**1 608**	**71**

Table 14.75 – HASLab – Summary of publications by members of the Centre

Publication Type	2023 (Consolidated)	2024 (Consolidated)	2025 (Consolidated)
Indexed Journals	23	21	23
Indexed Conferences	47	31	47
Books			
Book Chapters	1	2	1
Concluded PhD Theses – Members	2	6	5
Concluded PhD Theses - Supervised	2	6	6

Table 14.76 – HASLab – Summary of IP protection, exploitation and technology transfer

Type of Result	2023	2024	2025
Pre-Disclosures (PDF)		2	
Technology Disclosures (TDF)	2		3
First Priority Patent Applications (New Inventions)			1
First Patents Internationalisation			
First Patent Granted			
Commercial Contracts (Licences, Options, Assignments)			
Spin-offs established			
Spin-offs in development			

Table 14.77 – HASLab – Summary of dissemination activities

Type of Result	2023	2024	2025
Participation as principal editor, editor or associated editor in journals	3	5	5
Conferences organised by INESC TEC members (in the organising committee or chairing technical committees)	8	8	1
International events in which INESC TEC members participate in the program committees	34	26	17
Participation in events such as fairs, exhibitions or similar	4	3	4
Conferences, workshops and scientific sessions organised by the Centre	1	1	9
Participants in the conferences, workshops and scientific sessions organised by the Centre	82	30	250
Advanced training courses organised by the Centre	1	1	

Table 14.78 – HASLab – List of projects

Type of Project	Short Name	Leader	Starting date	Ending date (planned)
PN-FCT	IBEX	Renato Jorge Neves	01/01/2022	31/08/2025
PN-FCT	VeriFixer	Alexandra Sofia Mendes	17/02/2025	16/08/2026
PN-FCT	InfraGov	Alexandra Sofia Mendes	01/03/2025	31/01/2026
PN-FCT	SafeIaC	Alexandra Sofia Mendes	01/07/2025	29/06/2028
PN-FCT	BANSKY	Luís Soares Barbosa	01/09/2025	31/08/2028
PN-COOP	CDMS	Ricardo Gonçalves Macedo	01/01/2025	31/12/2026
PN-COOP	BCDSM	João Tiago Paulo	01/02/2024	30/01/2027
PN-COOP	BringTrust	Cláudia Vanessa Brito	01/07/2025	29/06/2028
PUE-DIV	EuroCC2	Rui Carlos Oliveira	01/01/2023	31/03/2026
PUE-DIV	EPICURE	António Luís Sousa	01/02/2024	31/01/2028
PUE-FP	HANAMI	Paula Cristina Rodrigues	01/01/2024	28/02/2027
PUE-FP	exaSIMPLE	André Martins Pereira	01/03/2024	28/02/2025
SERV-NAC	IDINA	João Marco	20/10/2021	31/03/2025
SERV-NAC	PeT	José Orlando Pereira	01/06/2024	31/05/2028
SERV-NAC	ENSCOMP4	José Nuno Oliveira	23/10/2024	30/06/2026
SERV-INT	JasminCode	José Bacelar Almeida	01/09/2025	31/08/2026
OP	Sustainable HPC-1	António Luís Sousa	01/07/2021	31/12/2025
OP	Deucalion	António Luís Sousa	01/01/2023	31/12/2026
OP	IFIPWG21	José Nuno Oliveira	28/04/2025	07/10/2025
OP	SRDS2025	José Orlando Pereira	01/05/2025	31/12/2025

Type of Project:

PN-FCT	National R&D Programmes - FCT
PN-PICT	National R&D Programmes - S&T Integrated Projects
PN-COOP	National Cooperation Programmes with Industry
PUE-FP	EU Framework Programme
PUE-DIV	EU Cooperation Programmes - Other
SERV-NAC	National R&D Services and Consulting
SERV-INT	International R&D Services and Consulting
OP	Other Funding Programmes

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2. Sequeira, A., "Quantum Reinforcement Learning: Foundations, algorithms, applications"
3. Macedo, J., "Strategic attribute grammars: techniques, tools and applications"
4. Oliveira, M., "The interplay between quantum foundations and circuit complexity"
5. Costa, L., "Aiding researchers making their computational experiments reproducible"

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