ANNUAL REPORT'20

INESCTEC

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Message from the Board

MESSAGE FROM THE BOARD

2020 will be remembered as a dramatically atypical and challenging year, but also as a year in which all of us at INESC TEC were capable of instantly holding hands in solidarity to strengthen and protect our community, while joining global scientific efforts to tackle an unprecedented health and economic crisis.

INESC TEC launched and participated in many actions that brought together experts from different disciplines as part of the response to the COVID-19 pandemic, from the early production of protective visors to the development of the emergency ventilator PNEUMA, the study "Diaries of a Pandemic", the contribution to the free app "Psicovida" and the world-wide CoronaSurveys, as well as the development of an Autonomous Robot for Disinfection in Hospitals and a COVID-19 Diagnosis System applied to chest X-Ray images. Among these numerous initiatives, INESC TEC's most prominent contribution was the design and development of the Portuguese digital contact tracing system for COVID-19, STAYAWAY COVID.

But 2020 was also a year of important advances in multiple fields in the realisation of our aspiration to Foster Pervasive Intelligence by creating new digital intelligence paradigms and applying them to a broad range of domains of expertise.

While Portugal became a "strong innovator" in the European Innovation Scoreboard, the year also marked the beginning of an always challenging period of transition between S&T funding cycles, both at European and national levels, and INESC TEC's R&D activity continued to be greatly influenced by two relevant public policy measures: the further implementation of the policy for scientific employment and the new Research Grant Holder Statute.

Despite the harsh context INESC TEC's activity increased 2% in 2020, extending a period of more than a decade of continuous and sustainable growth and maintaining a high level of R&D contracts with industry. Publications in indexed journals increased slightly to 398, 62% of which in first quartile journals, whereas indexed conference publications decreased due to the negative impact of COVID-19. The number of PhD theses supervised by INESC TEC researchers completed in 2020 increased 39%. INESC TEC remained one of the top five Portuguese organisations in net contribution and participation in H2020 competitive research funding. In the area of Intellectual Property protection and valorisation, in 2020 INESC TEC was, for the fourth consecutive year, among the top five national entities in patent applications submitted to the European Patent Office, and had three spin-offs in a development phase.

At the end of 2020, INESC TEC hosted more than 730 integrated researchers, 350+ with a PhD. The most noticeable evolution in human resources was the significant increase (26%) in the number of R&D employees (reaching a total of 152) due to the abovementioned policy for scientific employment, a further step in the progressive transformation of the profile of our research teams.

For most of the year, INESC TEC operated in a hybrid mode. Most of our researchers were in remote work and only essential support services shifts were present in the premises, which were adapted to the new reality. Laptops and web conferencing equipment went predominant, and digital repositories and processes were reinforced. Laboratory work was halted between March and May, and restarted with new rules enforced.

As for the support to public policies, INESC TEC provided ground contributions to the bureaucratic simplification in the area of S&T at a national level, in addition to a continuous involvement in the update of the regional and national smart specialisation strategies, and an active participation in nine Collaborative Laboratories (CoLABs) which took major initial steps in 2020. Still in the realm of its role as a key actor in the support to public policies, INESC TEC applied in 2020 for the renewal of its title of Associate Laboratory. The results of the call were disclosed early 2021 and INESC TEC received a classification of excellent and saw its title renewed for 10 years.

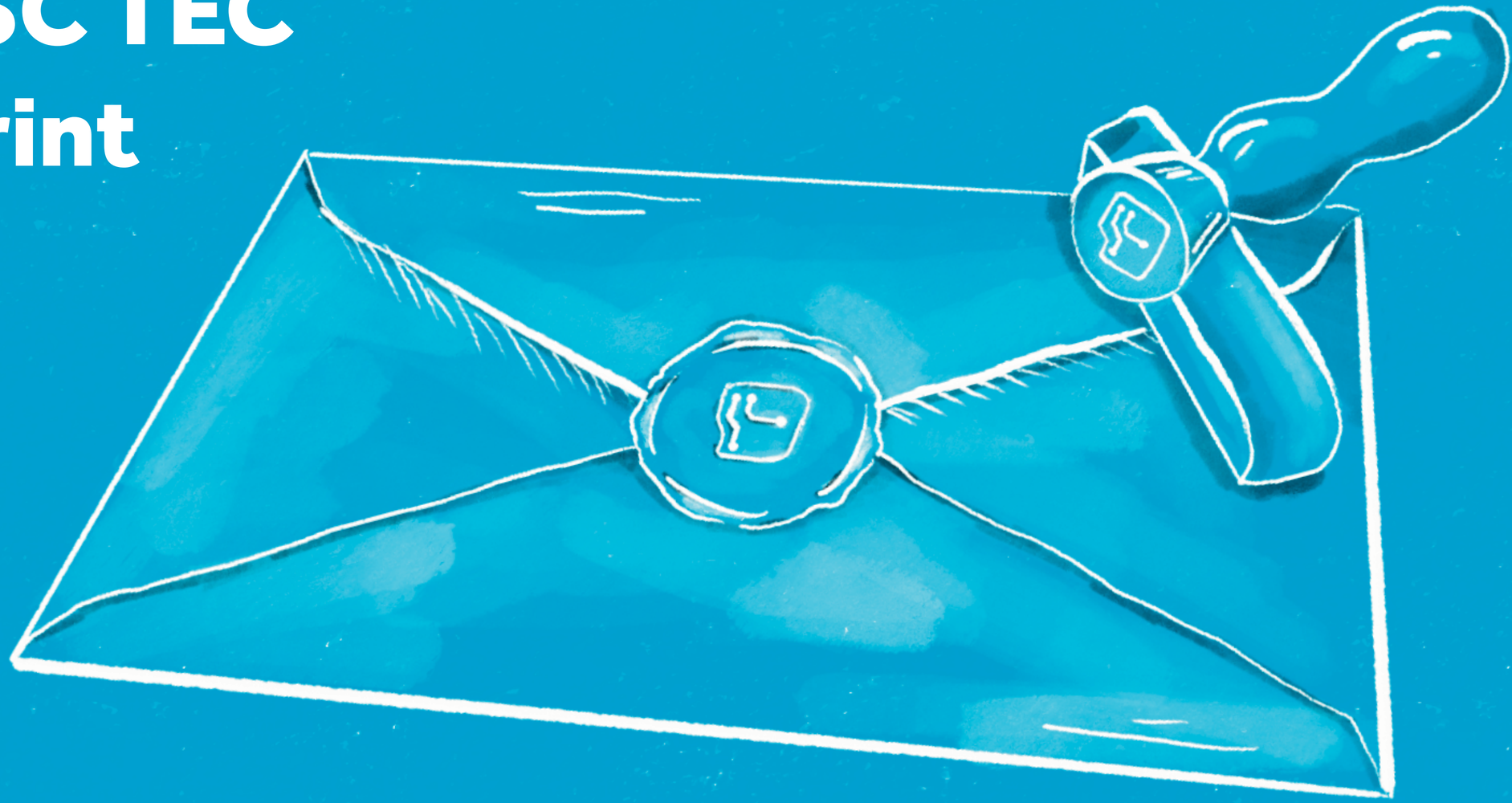
Our most recent initiatives did not falter in the face of the crisis: Internal Seed Projects were launched aiming at supporting internal exploratory R&D activities, INESC Brussels Hub saw its activity rise in the first full year of operation, and a new magazine, "INESC TEC Science & Society", aiming at disseminating science in society and contributing to the discussion of technology-influenced public policies, had its inaugural issue.

The year 2020 proved our resilience, adaptability, inner strength and determination to face uncertainty. It has brought the scientific community and society closer together, and INESC TEC stood up to help and solve problems, as inscribed in our DNA. On behalf of the Board of Directors, we thank the INESC TEC community for the resolve and generosity that made all these achievements possible in 2020.

It is already clear now that 2021 will still be a challenging and disrupted year. But, as the world endeavours to recover, we will be here to contribute, with our unwavering dedication and spirit of service, as we have been for the last 35 years.

1

INESC TEC imprint

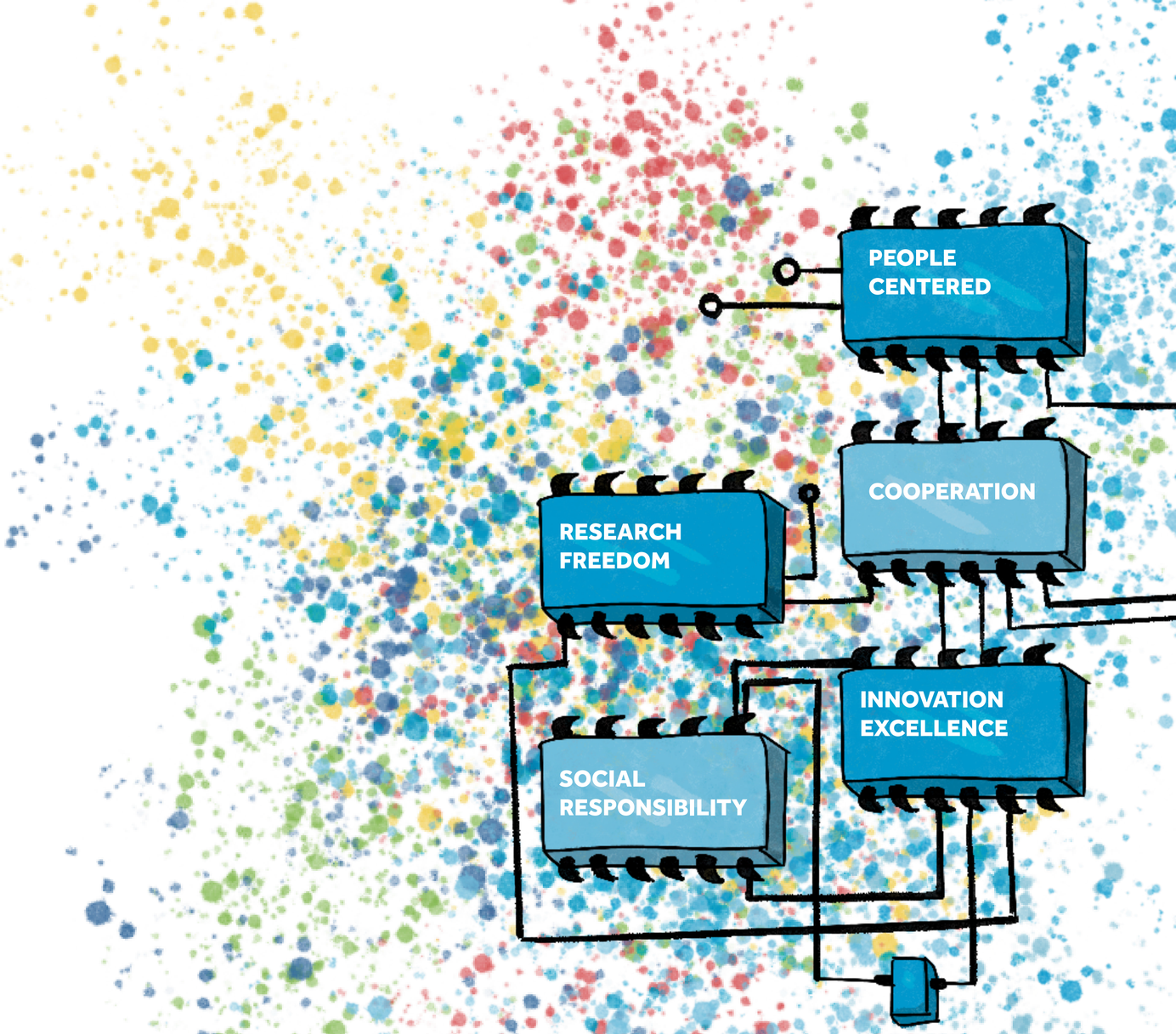


1.1
35 years: past, present and future

INESC TEC's vision is to be a relevant international player in science and technology in the broad domains of Computer Science, Industrial and Systems Engineering, Networked Intelligent Systems, and Power and Energy. The institute's dual mission is to excel in research and to seek its social and economic impact, with a unifying commitment to the scientific and technological aspiration of **fostering pervasive intelligence**.

WE **COVER THE KNOWLEDGE-TO-VALUE PRODUCTION CHAIN.**
WE **TRANSFER KNOWLEDGE, TECHNOLOGIES AND PEOPLE.**
WE **ENABLE SCIENCE-BASED INNOVATION.**
WE **OFFER ADVANCED CONSULTING AND TRAINING.**
WE **CREATE SPIN-OFFS.**

WE ARE **NETWORKED INTELLIGENT SYSTEMS.**
WE ARE **POWER AND ENERGY.**
WE ARE **INDUSTRIAL AND SYSTEMS ENGINEERING.**
WE ARE **COMPUTER SCIENCE.**
WE ARE **INESC TEC.**



1.2.
A cohesive multi-institutional alliance

FOSTER PERVASIVE INTELLIGENCE

OUR MISSION

Contribute to the competitiveness and internationalisation of Portuguese companies and institutions.

EXCEL IN RESEARCH

OUR MISSION

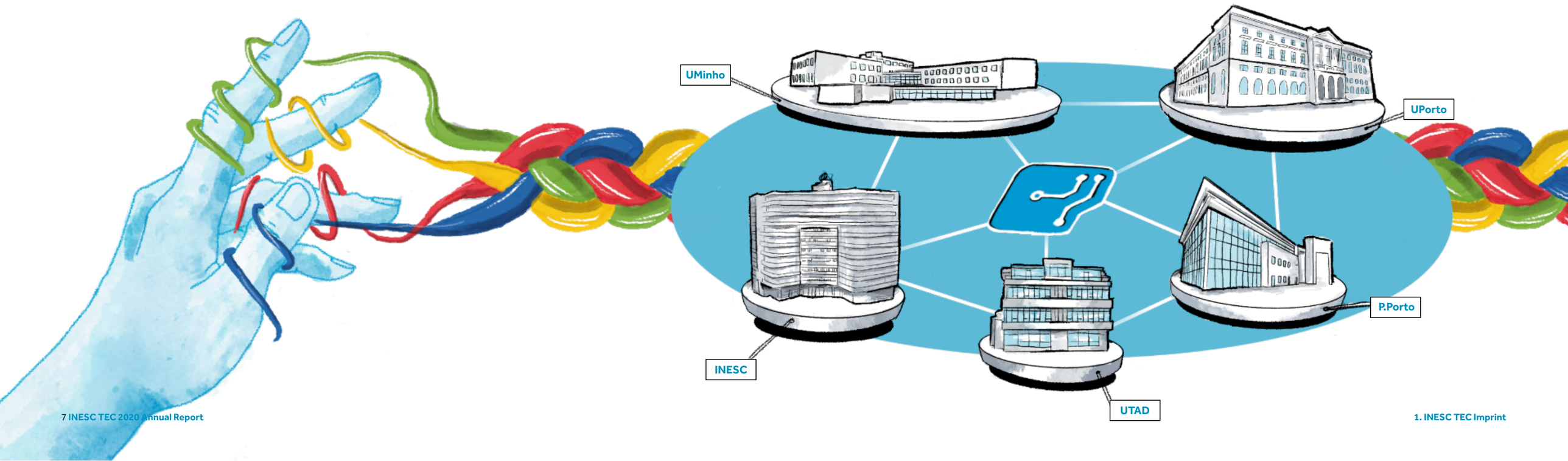
To be socially relevant and internationally influential.

ASSOCIATES

University of Porto
Polytechnic of Porto
INESC
University of Minho
University of Trás-os-Montes and Alto Douro

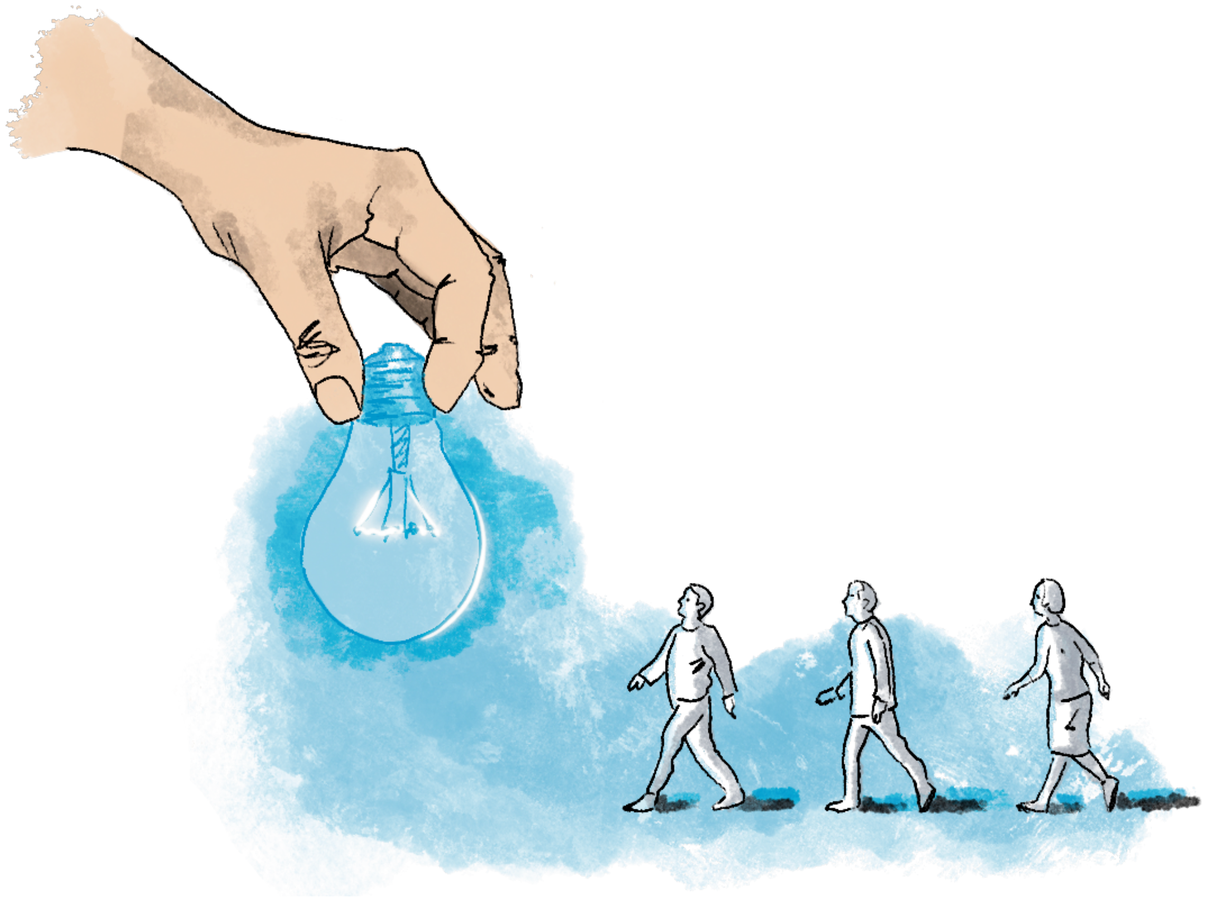
NUCLEI

Universidade Aberta
Instituto Politécnico de Bragança



1.3.
A multidisciplinary governance

INESC TEC is a private, non-profit, public interest association, dedicated to scientific research, technological development and knowledge transfer.
The high-level management of the institute is undertaken by a Board of Directors, led by the Chairman, and its Executive Board is in charge of the day-to-day management, led by the CEO.



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EXECUTIVE BOARD
Gabriel David

EXECUTIVE BOARD
Luís Seca

EXECUTIVE BOARD
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João Paulo Tomé Saraiva
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Rice University (USA)

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INRIA – Rennes (France)

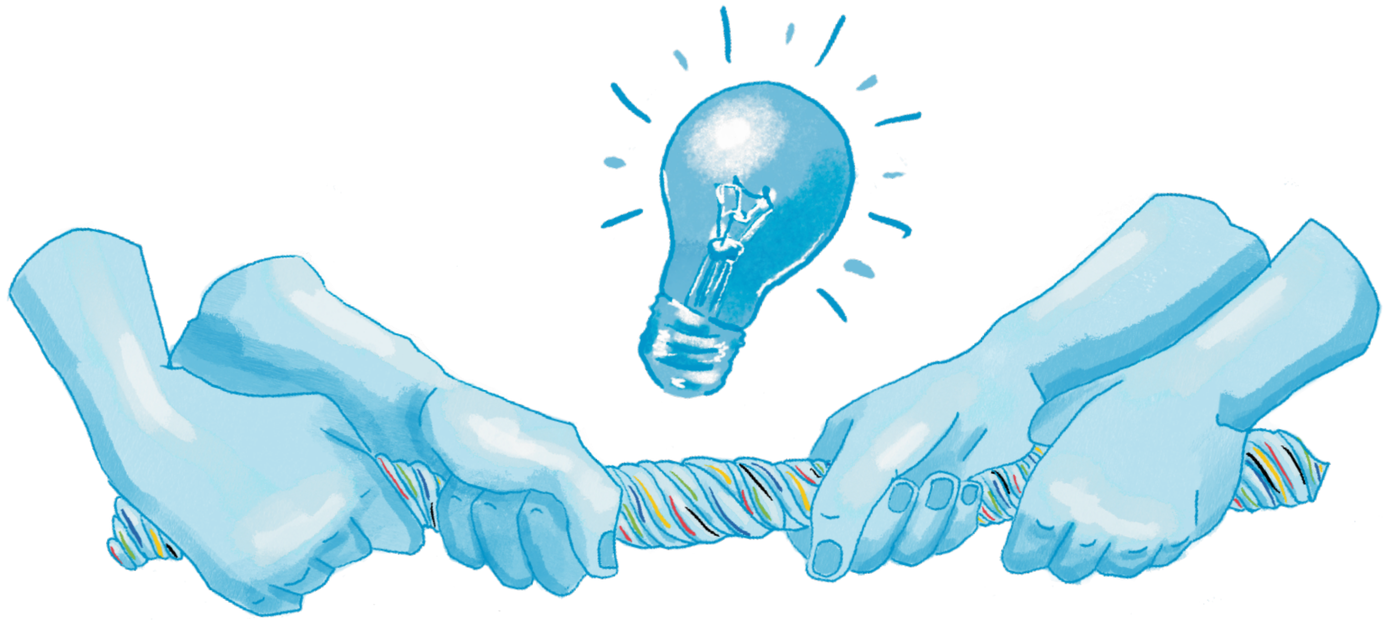
Masaru Kitsuregawa
Institute of Industrial Science, The University of Tokyo (Japan)

1.4.
Turning science into economic value

INESC TEC's science and technology aspiration to Foster Pervasive Intelligence is translated at mission level as the creation of new digital intelligence paradigms and their application in its domains of expertise, including key contributions to the design, implementation and evaluation of public policies related to the digital and climate priorities.

The Clusters bring together Centres in core scientific domains for R&D strategy development and long-term planning, and the TEC4 initiatives articulate the activities of the institution towards a set of main markets matching major societal challenges.

As a whole, this model implements a complete knowledge value chain, integrating four stages – knowledge production, applied research, development, and technology transfer – whose outcomes fall in different Technology Readiness Levels and whose activities are supported by different funding sources.



4 CORE R&D DOMAINS

- **NETWORKED INTELLIGENT SYSTEMS**
- **POWER AND ENERGY**
- **INDUSTRIAL AND SYSTEMS ENGINEERING**
- **COMPUTER SCIENCE**

RESEARCH
CLUSTERS BEHIND SCIENCE PUSH

Clusters of research centres build a multidisciplinary environment to optimise resources and maximise synergies.

INNOVATION
TEC4 BEHIND MARKET PULL

Strategy driven platforms addressing and impacting great societal challenges and market needs.

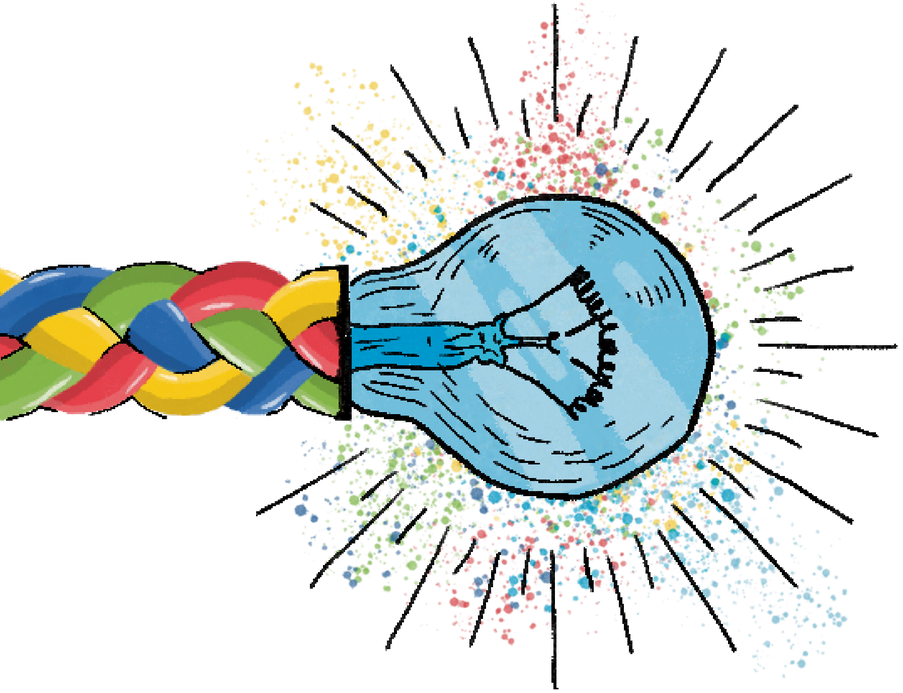
5 PLATFORMS SOCIETAL CHALLENGES AND MARKET NEEDS

- TEC4 **AGRO-FOOD**
- TEC4 **ENERGY**
- TEC4 **HEALTH**
- TEC4 **INDUSTRY**
- TEC4 **SEA**

1.4.1.
INNOVATION | TEC4

Strategy driven platforms addressing and impacting great societal challenges and market needs. The interaction with the main market application areas is articulated by five initiatives called TEC4 **("TEChnologies FOR ..."):**

- **TEC4SEA**
- **TEC4HEALTH**
- **TEC4AGRO-FOOD**
- **TEC4ENERGY**
- **TEC4INDUSTRY**



TEC4 **AGRO-FOOD**

Co-shaping the digital (r)evolution in Agro-Food and Forestry through research and technological development in Information and Communication Technologies and Electronics (ICT&E) and Robotics.

TEC4 **ENERGY**

Decabornization and digitalization of the energy sector, which will be heavily digitalised, decentralised, under a user centric and market based approach, involving a large scale integration of renewable power sources.

TEC4 **HEALTH**

Inducing human centered systems engineering towards personalised medicine, healthier life style and better health systems management.

TEC4 **INDUSTRY**

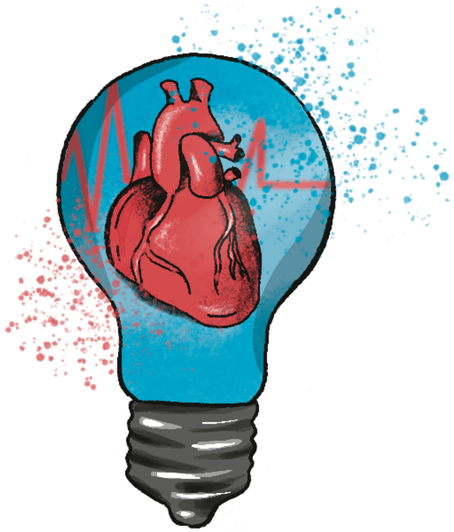
Generating a convergence of knowledge and competences into producing solutions for the Retail and Manufacturing Industry.

TEC4 **SEA**

Inducing R&D activities targeting sea and deep-sea challenges towards a sustainable Sea Economy.

TEC4 ENERGY

Main Innovation Services
- Energy Conversion and Efficiency
- Electrical Network Operation and Optimisation
- Electric Mobility
- Asset Management and Predictive Maintenance



TEC4 INDUSTRY

Main Innovation Services
- Factory design and operational planning
- Future industrial robotics and collaborative robotics
- Logistics and Retail
- Predictive Maintenance and Consumer Forecasting
- Digital transformation

TEC4 AGRO-FOOD

Main Innovation Services
- Smart Precision Agriculture and Forestry
- Bioeconomy
- Food Security

TEC4 HEALTH

Main Innovation Services
- Artificial Intelligence Enhanced Healthcare
- Predictive Analytics
- TeleHealth and Information Systems
- Healthcare Sensing and Monitoring

TEC4 SEA

Main Innovation Services
- 3D Mapping and data fusion in unstructured environments
- Development of optical and bio-sensors
- Broadband communications solutions for marine environments
- Data collection, processing and management

1.4.2.
RESEARCH | CLUSTERS

Research at INESC TEC is undertaken by 13 Research Centres, brought together in Clusters for strategy development and long-term planning of the institute's four scientific domains:

NETWORKED INTELLIGENT SYSTEMS

CTM Telecommunications and Multimedia
CAP Applied Photonics
CRAS Robotics and Autonomous Systems
C-BER Biomedical Engineering Research

POWER AND ENERGY

CPES Power and Energy Systems

INDUSTRIAL AND SYSTEMS ENGINEERING

CESE Enterprise Systems Engineering
CRIIS Robotics in Industry and Intelligent Systems
CEGI Industrial Engineering and Management
CITE Innovation, Technology and Entrepreneurship

COMPUTER SCIENCE

CSIG Information Systems and Computer Graphics
LIAAD Artificial Intelligence and Decision Support
CRACS Advanced Computing Systems
HASLab High-Assurance Software

NETWORKED INTELLIGENT SYSTEMS

Development of systems that can aggregate sensing, computer vision, communications and navigation components, using low power devices and implementing edge intelligence (including cyber-physical systems and autonomous systems), bearing in mind the capacity to adapt and learn from past experience.

RESEARCH LINES

- SENSING
- COMMUNICATIONS
- COMPUTER VISION
- AUTONOMOUS SYSTEMS

POWER AND ENERGY

Aligning with the EU policies for digitalisation, energy efficiency and increase in Renewable based Energy Sources (RES) integration, the cluster addresses the main challenges of the energy sector transformation, exploiting synergies between advanced mathematical modelling and digital technologies to support a reliable decarbonisation of the energy system.

RESEARCH LINES

- RENEWABLE ENERGY INTEGRATION
- POWER SYSTEMS PLANNING AND OPERATION
- SMART GRIDS AND DIGITAL ENERGY SYSTEMS

INDUSTRIAL AND SYSTEMS ENGINEERING

Research and innovation in systems and services applied to the management of value streams in different industries (e.g., manufacturing, process industries, retail, health and mobility). Technologies such as collaborative robots, optimisation, machine learning and blockchain are being thoroughly studied from the lens of operations management and decision support.

RESEARCH LINES

- OPERATIONS MANAGEMENT
- OPERATIONS RESEARCH & MANAGEMENT SCIENCE
- INDUSTRIAL INFORMATION SYSTEMS
- TECHNOLOGY ENABLED INNOVATION
- AUTONOMOUS SYSTEMS

COMPUTER SCIENCE

As computing becomes fully decentralised, mobile, increasingly autonomous, and ubiquitous, there is an increasing need to address many of these technological as well as societal challenges with competences on Artificial Intelligence, Computer Graphics and Virtual Environments, Cryptography and Information Security, Information Management and Systems, Parallel and Distributed Computing and Software Theory and Engineering.

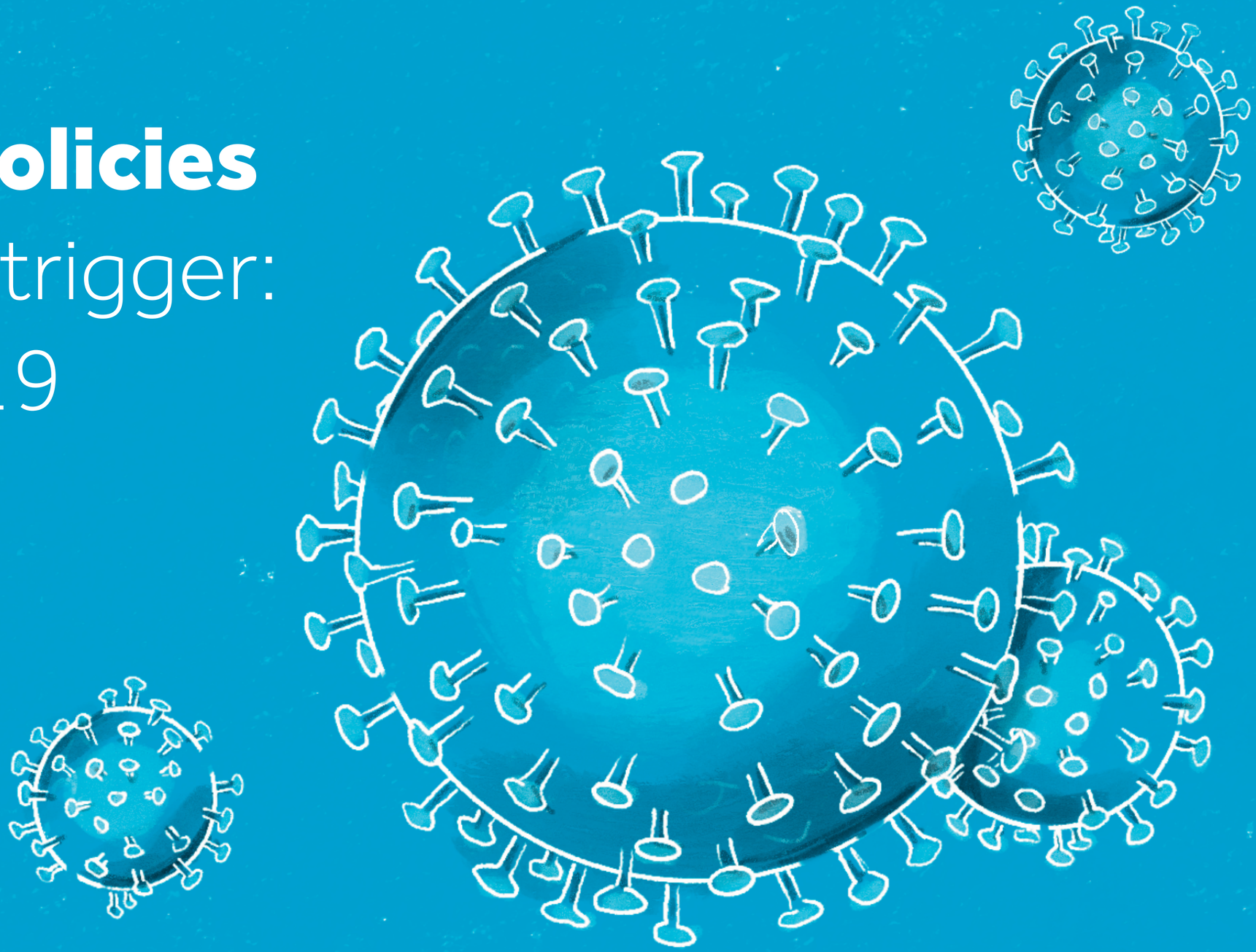
RESEARCH LINES

- BIG DATA & MACHINE LEARNING
- PRIVACY PRESERVING COMPUTING
- VIRTUAL ENVIRONMENTS
- TOOLS FOR RELIABLE SOFTWARE DEVELOPMENT

2

Public Policies

the new trigger:
COVID 19



2.1.
A Scientific Advisor

INESC TEC is a major national science and technology (S&T) policy actor, with international growing visibility. Its contributions to S&T policy in 35 years of history are manifold. As a result, INESC TEC strongly supports policies within the scope of the S&T system and contributes to critical S&T components in other policy areas.

To achieve such a goal, the main thrusts are: (1) the mobilisation of the institute's policy contribution capability towards European and national priorities, (2) the strengthening of its articulation with policy making.

To accomplish its mission, INESC TEC defines the following internal strategic priorities:

Full coverage of the knowledge value chain: new research opportunities, enhanced sustainability, appropriate focus of R&D capabilities.

Excellence in research, talent development, and innovation: stronger infrastructures, enhanced international recognition, proximity to PhD and MSc programs, complete portfolio of institutional policies.

Integration and multidisciplinarity: multidisciplinary project teams from different centres and complementary organisations, internal seed projects.

Scale, density, and critical mass: multi-institutional base, endeavour to attract leading researchers.

International visibility and presence: consolidation in Europe, strengthen foothold in other continents.

Ethics, social responsibility, and diversity and inclusion: building on a practice of compliance with non-discrimination and equality rules, committing to a more pro-active approach to a diverse and inclusive community.

2.2.
Playing an active role

Combining knowledge, integrity, transparency and multidisciplinarity, INESC TEC's competencies allowed the institute to become able to advise and support public policies and also to support them. INESC TEC's availability goes from support in emergency situations, to solutions for the electrical energy area, for innovation in industry or the strengthening of digital competences.

As a partner for national strategic priorities, playing an active role during the pandemic that hit all at the beginning of 2020 was a mission immediately taken on with full commitment.

Even though facing new and tremendous challenges, shared with every individual and organisation around us, INESC TEC's community mobilised to respond to COVID-19. Several initiatives were launched and supported, to provide solutions in critical areas of concern, seeking multiple positive impacts on the course of this pandemic. The recovery from the health crisis and the economic downturn that will follow will continue to require INESC TEC's full commitment and initiative.

STAYAWAY COVID

A privacy-preserving digital contact tracing system for COVID-19.
Over 3 million downloads

PNEUMA

A low-cost and easy to assemble ventilator with a self-inflating bag, in order to support Portuguese hospitals addressing the new coronavirus.
220 units produced

DIARIES OF A PANDEMIC

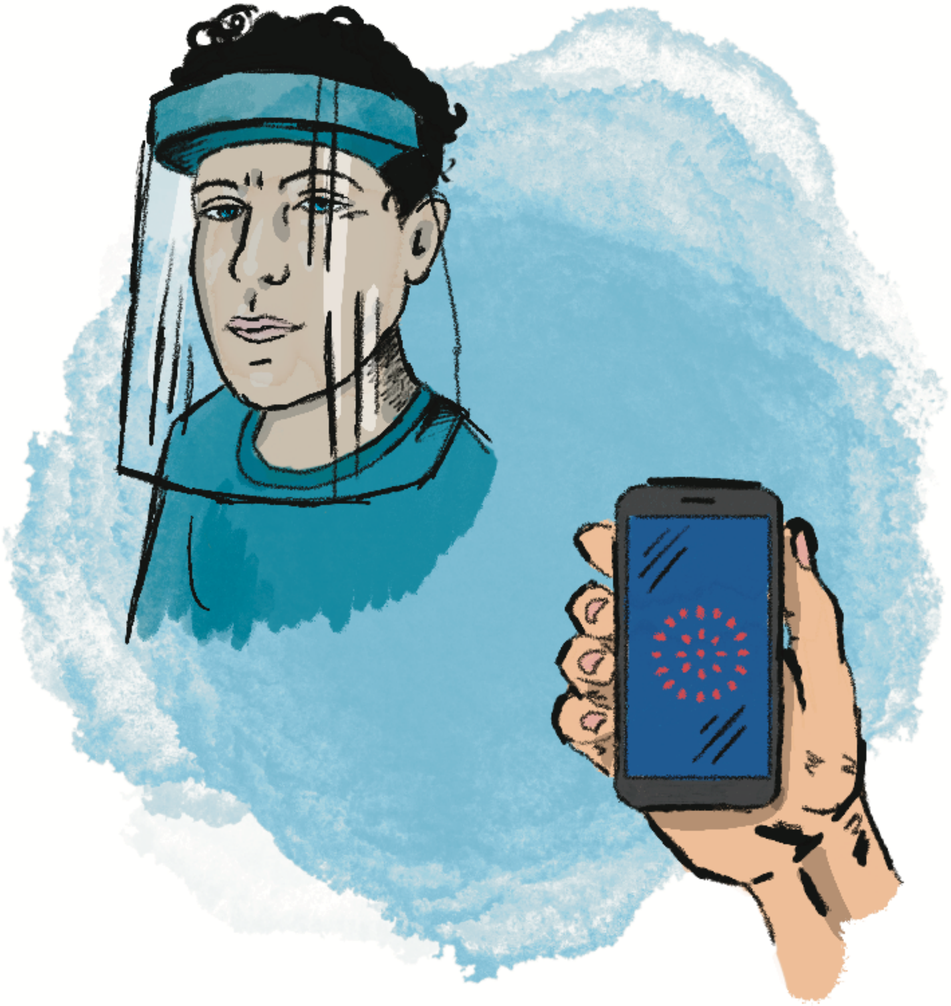
An online daily survey to help understanting the evolution in the lives of Portuguese people during the COVID-19 pandemic.
Over 13 000 participants

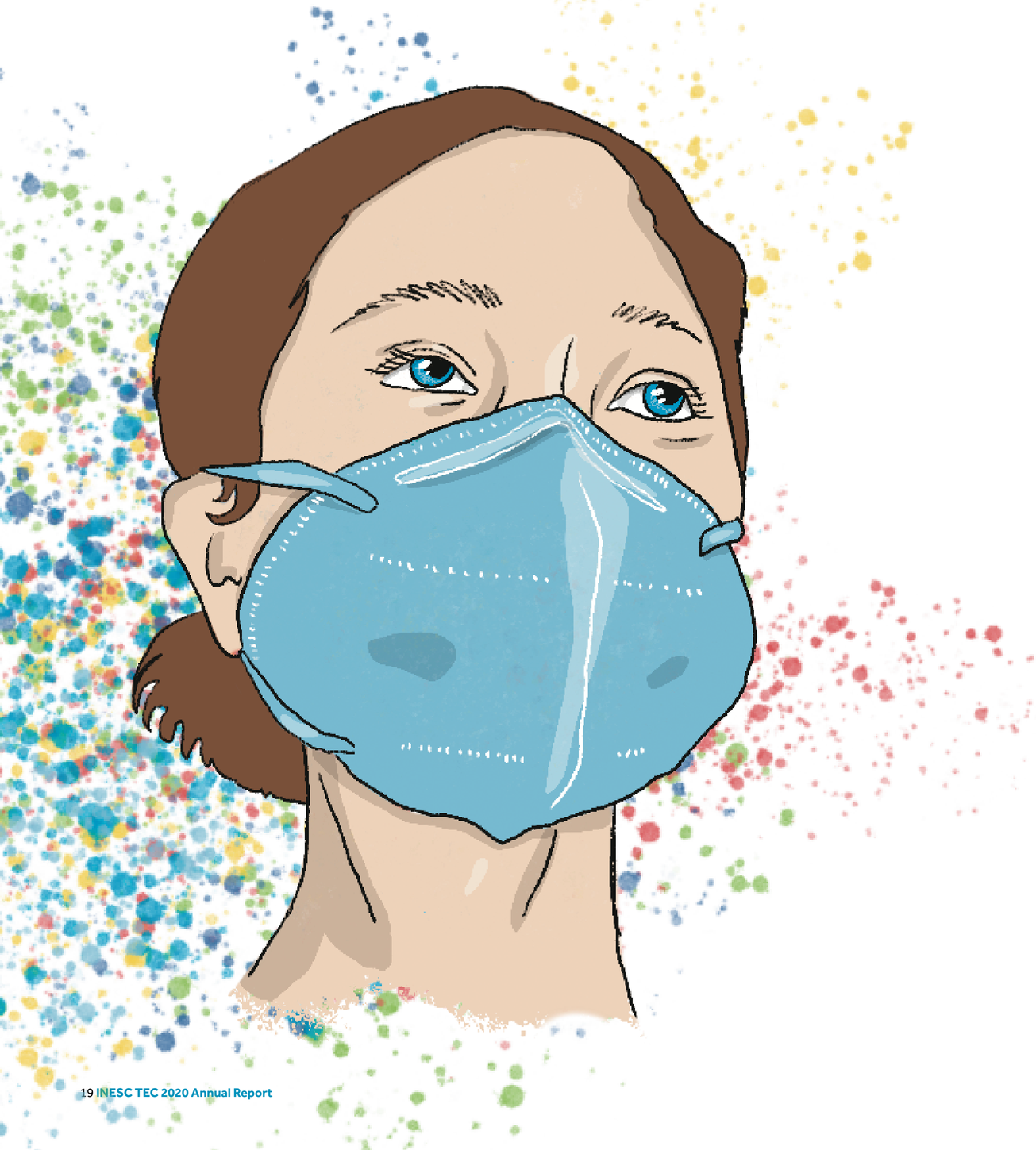
PRODUCTION OF VISORS

Distributed among several healthcare units in the Northern region, these visors are 3D printed and they are crucial to protect the healthcare professionals who are fighting against the pandemic.
Over 1 000 visors/day

CORONASURVEYS

Development of an international study to determine the incidence of the pandemic through an open social media survey in order to estimate the number of confirmed cases with COVID-19 symptoms and monitor their evolution in eleven countries.
About 20 000 answers





PSICOVIDA

A new mobile application to provide free psychological support to all those who need it, particularly due to the COVID-19.

RADAR – AN AUTONOMOUS ROBOT FOR DISINFECTION AT HOSPITALS

The autonomous robot will help disinfecting rooms at hospital units, through sensors and UV lamps.
Up to 99,9% efficiency

CXR_AI4COVID-19

Focuses on the use of Artificial Intelligence to analyse thorax X-RAYS, in order to identify the presence of COVID-19 in certain lung regions, thus providing a second opinion to the healthcare professionals involved in screening patients with COVID-19.

LIG@R

Aims to maximise the number of students with access to online classes during the pandemic, thus benefiting from the use of digital platforms.

SUPPORTING THE DIGITISATION OF SMES

The digitisation of Small and Medium Enterprises (SMEs) is a transformational process whose relevance and urgency became clearer in the context of the current pandemic.

COVID_3DPRINT INITIATIVE

Focusing on 3D printing technology to produce medical devices – supported by a network of volunteers, also contributing to the development of an information and decision support system for planning the production and distribution of printed products.

CAIRUS – COVID-19 ARTIFICIAL INTELLIGENCE-BASED RISK UNIFIED STRATIFICATION TOOL FOR CLINICAL MANAGEMENT

The project proposes a fast and low-cost stratification tool for the prediction of clinical results in patients with COVID-19 – based on serum analysis – using a validated artificial intelligence photonic platform.

THOR - COMPUTER ASSISTED THORACIC ASSESSMENT USING POCUS

Will test the use of Artificial Intelligence in the diagnosis of COVID-19, by analysing chest ultrasounds using computer vision techniques.

VITALPROVID

Patient Monitoring system during and after COVID-19, focusing on the research and discovery of new health indicators of COVID-19 disease based on physiological signals collected by an innovative wearable device.

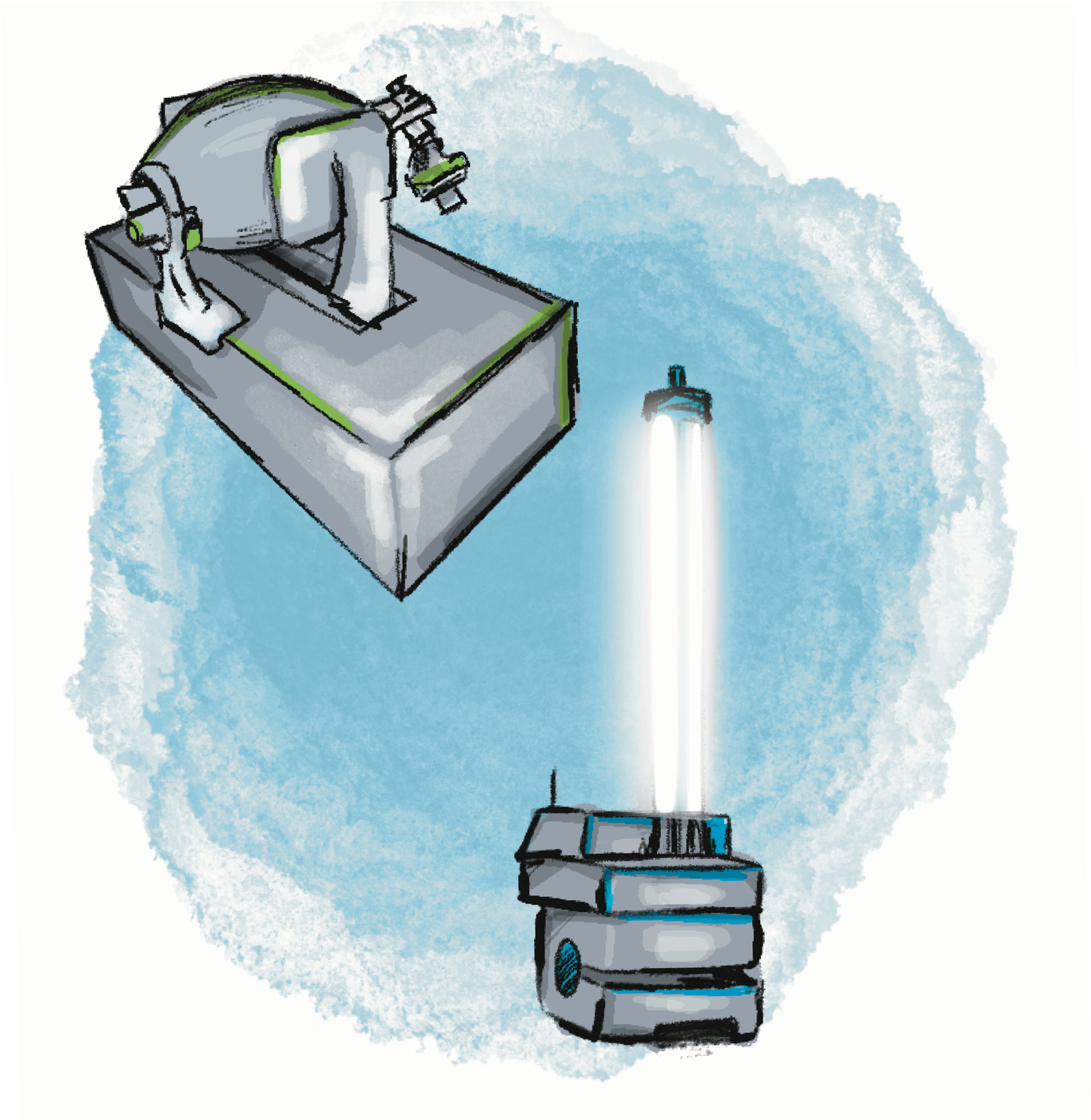
OTHER CONTRIBUTIONS

• Contributions to administrative simplification in the area of Science and Technology at a national level, namely being part of the Working Group created by the Portuguese Government to simplify R&D applications for the Portugal 2020 programme;

• Continuing involvement in the update of the regional and national smart specialisation strategies in the institute's areas of expertise, including Advanced Manufacturing Systems; Culture, Creation and Fashion; Life Sciences and Health; Mobility Industries and Environment; Marine Resources and Economy; Agri-environmental Systems and Food;

• Contributions to the procurement, funding and hosting conditions of the EuroHPC JU petascale system "Deucalion" to be installed in the AvePark.

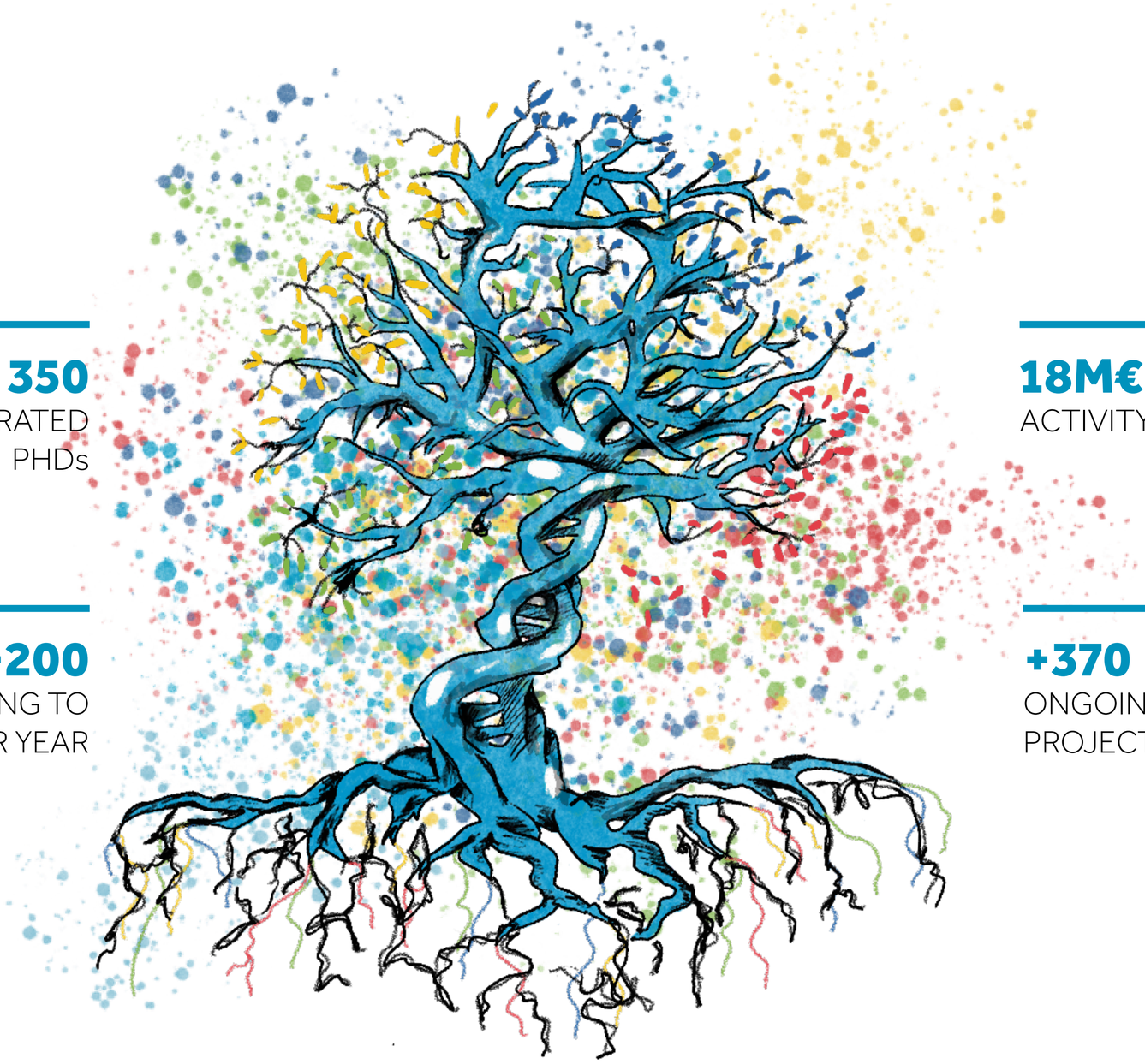
• The nine Collaborative Laboratories (CoLABs) that INESC TEC is associated with, gave major initial steps in 2020, opening opportunities to expand research into their areas of application, strengthen knowledge sharing and enhancement, create highly qualified jobs for young talent, and overall strengthen the institute's position as an interface institution of excellence.



3

2020 highlights

3.1.
Activity overview



+730
INTEGRATED RESEARCHERS

350
INTEGRATED PHDs

18M€
ACTIVITY

37
PATENT APPLICATIONS (7 GRANTED)

+25
NATIONALITIES

+200
PEOPLE GOING TO THE MARKET PER YEAR

+370
ONGOING R&D PROJECTS

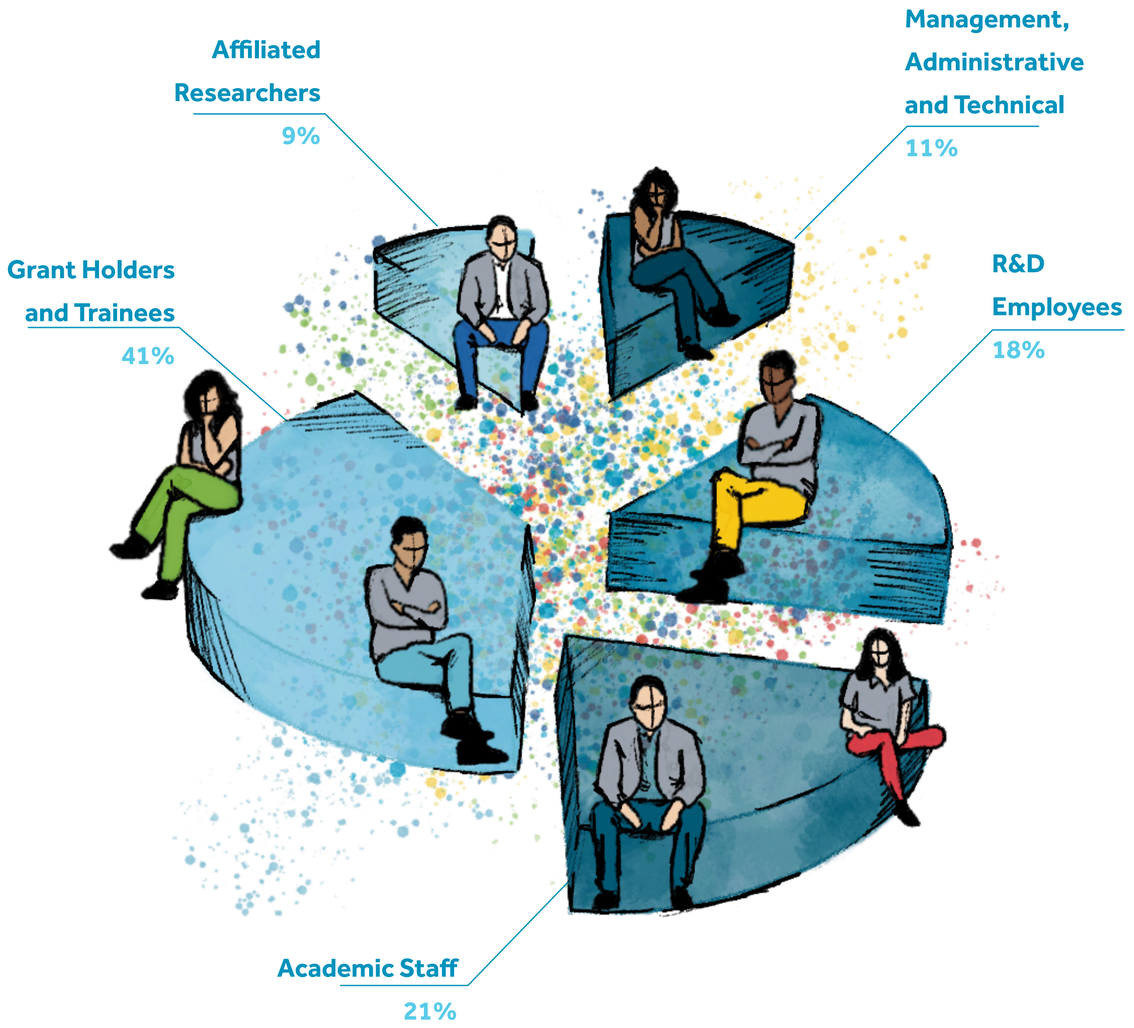
7
ACTIVE SPINOFFS (TRACK-RECORD: +20)

3.1.1.
HUMAN RESOURCES OUTLOOK

IN 2020...

INESC TEC grew in Excellence, since people are its driving force. As one of the leading Portuguese organisations in scientific employment, multifaceted teams of researchers constitute the foundations of INESC TEC's strategy. Also taking on the role of a hub of talent, INESC TEC has more than 200 professionals transferred to market per year.

Types of Human Resources		Clusters			
		NIS	PE	ISE	CS
Core Research Team	Employees	43	28	49	32
	Academic Staff	40	9	33	87
	Grant Holders and Trainees	113	42	67	111
	Total Core Researchers	196	79	149	230
	Total Core PhD	66	25	63	110
Affiliated Researchers		15	7	24	31
Administrative and Technical	Employees	6	3	5	4
	Total Administrative and Technical	6	3	5	4
Total Integrated HR		**217**	**89**	**178**	**265**
Total Integrated PhD		**80**	**32**	**84**	**140**

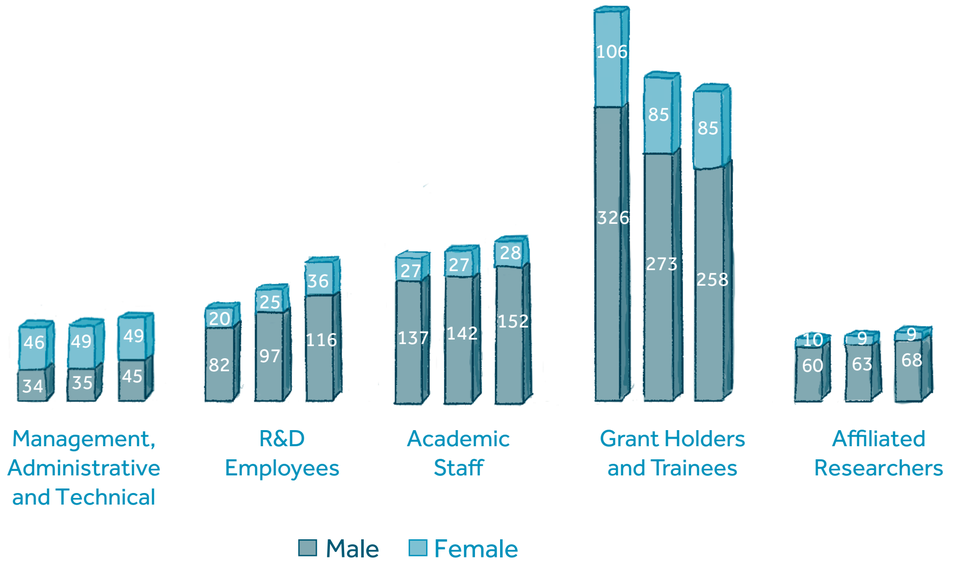


FOR THE PAST THREE YEARS...

INESC TEC has been thriving firmly and steadily, continuing its bet on the most valuable asset that the institute has been constructing, people.

Grant holders and trainees are still the largest group of human resources, featuring, nevertheless, a minor decrease in 2020, which may be explained by two different sets of reasons. First of all, the modified Research Grant Holder Statute that came into force in 2019 constraining the award of grants to non-PhD researchers to those who are enrolled in a higher education program. Secondly, as a result of the implementation of the Portuguese Government's policy for scientific employment, the number of R&D employees has been steadily rising, namely for PhD researchers.

The increase in Human Resources in Services aims at supporting the continued growth of the institute's activity and the operationalisation of new strategic objectives. Overall, the total number of integrated human resources remains stable between 2019 and 2020, as does the size of the academic staff.



Types of Human Resources		2018	2019	2020	2019-2020	
Core Research Team	Employees	102	121	152	31	26%
	Academic Staff	155	160	169	9	6%
	Grant Holders and Trainees	418	351	334	-17	-5%
	Total Core Researchers	**675**	**632**	**655**	**23**	**4%**
	Total Core PhD	**259**	**257**	**264**	**7**	**3%**
Affiliated Researchers		70	72	77	5	7%
Management, Administrative and Technical	Employees	80	84	94	10	12%
	Academic Staff	9	9	11	2	22%
	Grant Holders and Trainees	14	7	9	2	29%
	Total Management, Administrative and Technical	**103**	**100**	**114**	**14**	**14%**
Total Integrated HR		**848**	**804**	**846**	**42**	5%
Total Integrated PhD		**339**	**341**	**354**	**13**	4%

3.1.2.
PUBLICATIONS & PROJECTS

Networked Intelligent Systems

94	Journal papers
66	Conference papers
0	Books
3	Book Chapters
4	Concluded PhD theses - members
4	Concluded PhD theses - supervised

Industrial and Systems Engineering

100	Journal papers
78	Conference papers
1	Books
11	Book Chapters
6	Concluded PhD theses - members
8	Concluded PhD theses - supervised

Power and Energy

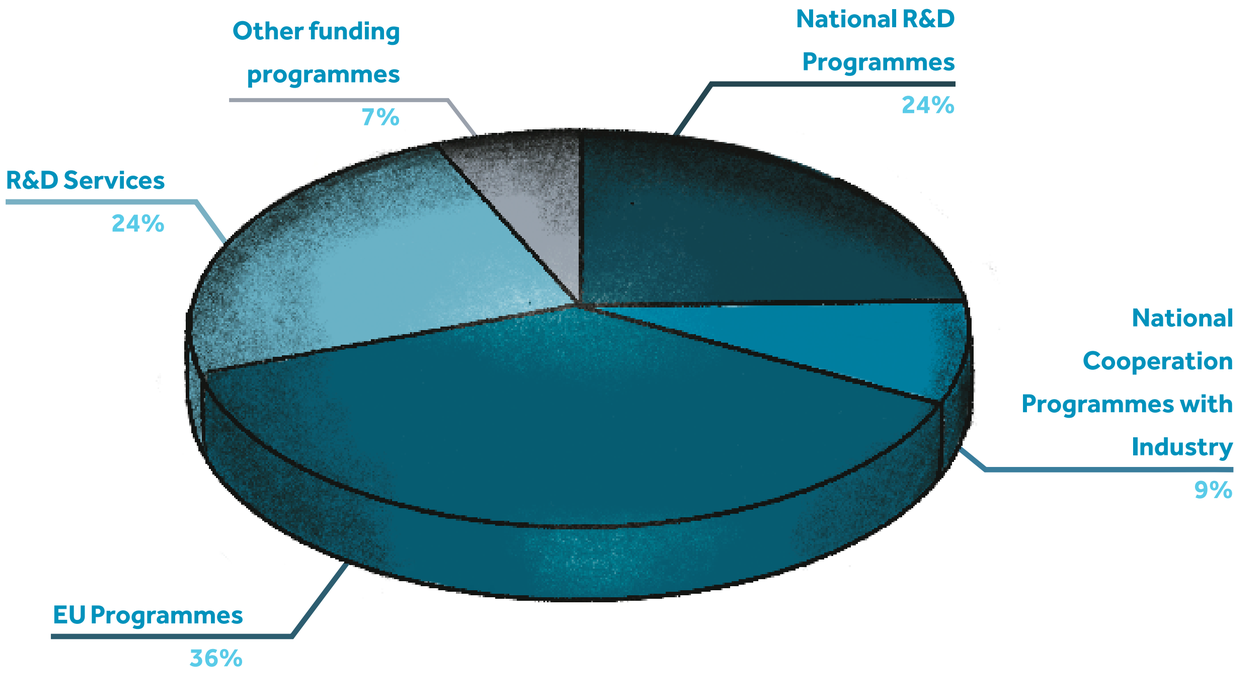
110	Journal papers
49	Conference papers
1	Books
6	Book Chapters
3	Concluded PhD theses - members
4	Concluded PhD theses - supervised

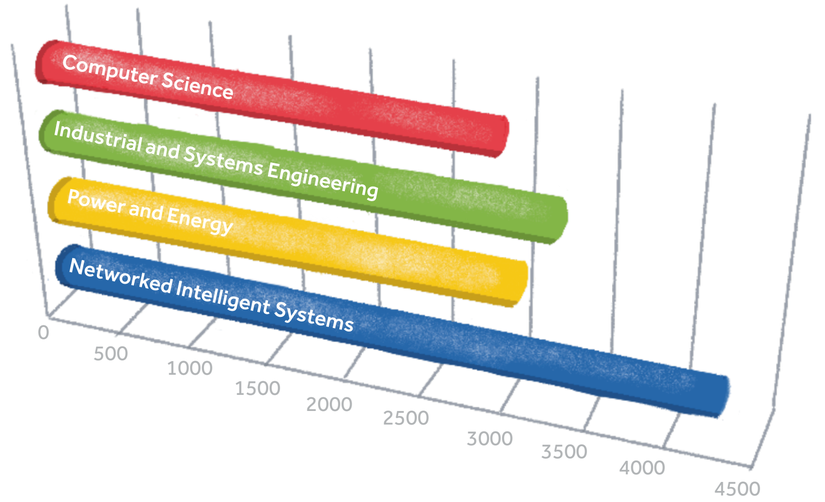
Computer Science

114	Journal papers
147	Conference papers
0	Books
5	Book Chapters
15	Concluded PhD theses - members
30	Concluded PhD theses - supervised

3.1.3.
FUNDING

INESC TEC has been participating in European framework programmes since the early '90s and from then on this participation has grown steadily in size and importance throughout the years. Nowadays international funding (mostly coming from European programmes) represents more than 30% of INESC TEC total funding demonstrating not only the importance of this source of funding for INESC TEC activities, but also its capacity to attract international funding.





Funding Source	Clusters			
	NIS	PE	ISE	CS
National R&D Programmes - FCT	1419	246	754	706
National Cooperation Programmes with Industry	561	25	459	205
EU Framework Programmes	1219	1 693	1 341	643
EU Cooperation Programmes - Other	159	0	55	86
R&D Services and Consulting - National	449	802	656	980
R&D Services and Consulting - International	349	131	5	61
Other Funding Programmes	79	157	4	210
Total Projects/Funding (in k€)	**4 257**	**3 055**	**3 275**	**2 892**

3.1.4.
DISSEMINATION

As an institution that intends to bring closer together academia, companies, public administration, and society, INESC TEC typically applies the knowledge and results generated as part of its research in seeking value creation and immediate social relevance. Therefore, an important task involves the dissemination of research results, projects development and other scientific activities. In spite of the forced digitalisation of 2020, results are still encouraging.

Participation as principal editor, editor or associated editor in journals	90
Conferences organised by INESC TEC members (in the organising committee or chairing technical comittees)	74
International events in which INESC TEC members participate in the program committees	273
Participation in events such as fairs and exhibitions	63
Conferences, workshops and scientific sessions organised by INESC TEC	41
Participants in the conferences, workshops and scientific sessions organised by INESC TEC	5 488
Advanced training courses organised by INESC TEC	20

3.2.
Special initiatives

3.2.1.
UT AUSTIN PORTUGAL

Coordinators: José Manuel Mendonça and Rui Oliveira

The UT Austin Portugal Program is a partnership between the Portuguese Science and Technology Foundation (FCT) and the University of Texas at Austin (UT Austin). For over a decade, these two transatlantic partners have thrived on creating a genuinely collaborative R&D ecosystem that brought together universities, research performing institutions and laboratories, technology transfer offices and companies in Portugal with UT Austin's counterparts. In the third phase of the Partnership, collaborations go beyond Austin to encompass another institution that is part of the University of Texas System: the MD Anderson Cancer Center, based in Houston.

UTAustin Portugal

Main achievements in 2020:

2019 Strategic and Exploratory Research Projects
The Partnership announced its support to three-year-long industry-led consortia focused on delivering innovative science-based solutions to a range of application markets, selecting eleven high-scored transatlantic consortia for funding.
The Program also worked with FCT to set up the 2019 Call for Exploratory Research Projects' evaluation process, that led to eight high-risk/high-impact projects being granted funding.

Annual Conference and Masterclasses
The Conference, whose underlying theme was Innovation at the Intersection of Academia and Industry, turned out to be a far-reaching event, with two Keynote Sessions and four e-Masterclasses. The Conference even staged an e-Poster Exhibition and e-Networking Corner.

Monitoring and Internal Stakeholders' Engagement Activities and Communication Activities
The Program put in place a monitoring and evaluation system that attests to its learning and improvement culture and intention to disseminate and communicate the outputs and outcomes of its main activities.
In 2020, the Program organized its first Governing Board and External Review Committee Meetings since Phase 3. In February, the Program's Leadership met with the Area Directors in Portugal to present them the 2020 Activity Plan and receive their inputs and suggestions.

3.2.2.
INESC P&D BRASIL

Coordinator: Vladimiro Miranda

INESC P&D Brasil is a private non-profit R&D association, recognized by the Brazilian Government. It coordinates the joint work of research groups within its associates, belonging to 14 top Brazilian universities. As an independent institution, its partners agreed to trust INESC TEC with the leadership of this shared management, exploring synergies in projects in South America and the European Union.

Main achievements in 2020:

- 8th consecutive year with positive accounting despite COVID-19 pandemic conditions
- Increased joint projects with INESC TEC
- More national and international advanced consultancy contracts
- Increased scientific publications and seminars

Key projects:

FASTEN VITA
Adaptation of an automated pulmonary ventilation equipment (PNEUMA) developed at INESC TEC to operational conditions in Brazil in a humanitarian aid initiative related to the effects of the COVID-19 pandemic.

MORA
Model for Operational Reserve Adequacy, aims to develop a computer system to assess the security of electricity supply in multi-area systems.

ROV
Development of a mechatronic system (a remotely operated vehicle) for cleaning and inspection of the stop and sealing threshold of Hydroelectric Stop Logs.

VEARREN 2030
Strategic Vision, Architecture and Roadmap for National Energy Networks, aims to evaluate the security of power supply with the participation of consumers in providing flexibility in the power system.

PLANEST
Criteria Update and Elaboration of Procedures for Planning the Expansion of the Brazilian Transmission System, aims to create documented procedures for planning the expansion of the Brazilian transmission system.

3.2.3.
INESC BRUSSELS HUB

Head of the office: Ricardo Miguéis
Coordinator of INESC Brussels HUB at INESC TEC: José Carlos Caldeira

The HUB is the European representation of the 5 INESC institutes (INESC Coimbra, INESC ID, INOV, INESC MN and INESC TEC) at the heart of the European Union. Its goal is to affirm INESC as a European reference organisation both for its research and innovation excellence and capacity to contribute to society, policy and the economy.

INESC BRUSSELS HUB

The activity of the HUB is divided into three main strategic action lines:

1) Promote visibility and reputation of INESC research and technology development capacity in Europe.
2) Contribute to training and capacity building of its technical, research and administrative staff.
3) Position the organisation as a relevant European stakeholder in strategic thematic domains through active participation in agenda-setting, lobbying processes and contribution to S&T and R&I policy analysis.

Main achievements in 2020:

Capacity and strategic positioning building
- Organised 4 meetings with European Commission, delegates to H2020 and INESC researchers.
- Organised a meeting between representatives of the 5 INESC Boards and the Portuguese Members of the European Parliament about main strategic positioning indicators.
- Supported the development of 5 tenders (1 approved – with the participation of INESC TEC and INOV), 1 Cost Action (INESC TEC) and 1 ESFRI proposal.
- Organised 3 workshops for 220 INESC research and support staff (Gender, HT, Digital EU programmes) and 1 training for about 100 INESC researchers on Horizon Europe.
- Coordinated the activity of 2 thematic work groups, the POB and TFF activities, resulting in the joint INESC responses to 4 public consultations and 7 draft Horizon Europe work programmes.
- Represented INESC in 5 European platforms, including EARTO, and in 7 project meetings.
- Started visibility activities with the EU affairs publication Science|Business.
- Produced and published 8 podcasts with a total reach of 3200 individual international IPs.

Policy analysis and lobbying:
- Produced 7 newsletters with key information and interpretation of EU funding programmes.
- Published a position paper on synergies with wide impact in EU institutions and national entities.
- Lobbied towards the creation of funding lines for technology infrastructures in Horizon Europe.

3.2.4.
COLLABORATIVE LABORATORIES

FORESTWISE

Led by INESC TEC, FORESTWISE aims at developing applied research, innovation and transfer of technology activities, in order to enhance the competitiveness of the Portuguese forestry sector, and minimise the negative effects of wildland fire.

BUILT

The BUILT CoLAB aims to develop innovative solutions for adaptable, smart, resilient and sustainable infrastructure and buildings. BUILT brings together academia, research organisations, industry agents and end users in a collaborative environment, leading to a common value creation model that will contribute to the transformation of the Architecture, Engineering and Construction sector (AEC).

B2E

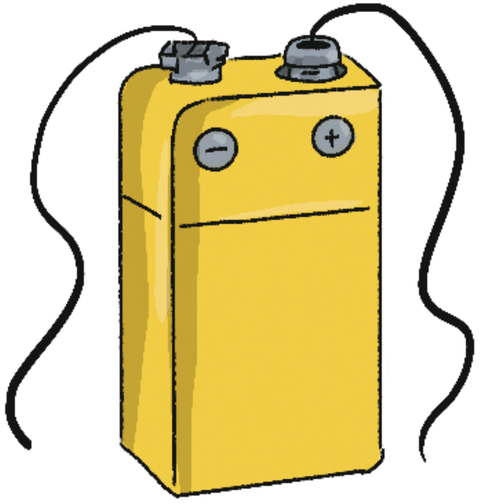
Under the motto "Ocean-Inspired - Market Driven - Knowledge Fuelled", CoLAB B2E aims to promote the creation of highly skilled jobs that will actively contribute to increase the economic and social value of products and services – according to new and existing biological processes, including the internationalisation of national scientific and technological expertise. In this sense, B2E focuses on supporting two of the blue growth sectors with the most potential: biotechnology and aquaculture.

VINES&WINES

The mission of the VINES & WINES CoLAB is developing and communicating knowledge and technology, in order to support the wine sector's estimated growth of 25% in export value (to reach €1 billion over the next five years). This CoLAB also aims to prepare and adapt the national wine system for the major challenges it faces – like climate change, for instance.

SMART ENERGY LAB

SeLAB aims to fill a gap in the academic/industrial energy ecosystem by finding solutions that help the energy transition process of energy users. The CoLAB's research and innovation agenda stems from the development and convergence of knowledge about key verticals in the industry, along with key multidisciplinary: a) Industry Verticals: the distributed Management of Energy Resources; Power management; Flexibility; Storage; Mobility; b) Horizontals: Engineering; IoT; Computer hardware and software; Big Data and Artificial Intelligence; Cyber security; Service Design and Design Thinking; UX/UI.



VASCO DA GAMA

VG-CoLAB - Energy Storage is focused on providing high technology services and added-value products, as well as innovative solutions for its partners and the market, particularly in the field of electrochemical energy storage. This CoLAB contributes to the implementation of the European energy transition agendas, by supporting the development of world leading energy transition technologies and solutions.

VORTEX

Combining the potential of academic and industry research models, Vortex aims to become the largest international hub for accelerating innovation and knowledge and technology transfer in the areas of cybersecurity and cyber-physical systems. In this sense, Vortex will actively contribute to accelerating innovation and the development of cutting-edge technologies, closing the current gap between research institutions.

FEEDINOV

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.

SFCOLAB

Generator centre of innovative digital solutions and automated for efficient resource management, and to maximise the added value of domestic products of horticulture, fruit growing and viticulture.

3.3.
Major achievements

The institute's main achievements in 2020 are presented according to the following areas:
- **Good health and well-being**
- **Affordable, sustainable and clean energy**
- **Innovative industry and infrastructure**
- **Environment action (below water and on land)**
- **Partnerships for the Sustainability Development Goals**

INESC TEC selected some of the UN's Sustainable Development Goals and adapted them to the institute's activity, in order to present the 2020 main highlights, thus recognising the importance of contributing actively to the global efforts towards achieving social, economic and environmental sustainability.

Looking back at the beginning of 2020, INESC TEC had committed to a set of critical institutional initiatives that would enable the institute to strengthen its intervention capacity in the national and international Science and Technology systems, and its ability to carry out its mission in the benefit of society in general. INESC TEC's response to the pandemic crisis no doubt greatly leveraged these efforts, to adapt swiftly to a new reality, with an even more demanding societal agenda.

Not failing to keep up with its characteristic hard work, INESC TEC maintained in 2020 a high level of accomplishments, from which only a representative set is presented next, always referring also to their main corresponding Cluster, Research Line and TEC4 initiative.

NETWORKED INTELLIGENT SYSTEMS

- SENSING
- COMMUNICATIONS
- COMPUTER VISION
- AUTONOMOUS SYSTEMS

POWER AND ENERGY

- RENEWABLE ENERGY INTEGRATION
- POWER SYSTEMS PLANNING AND OPERATION
- SMART GRIDS AND DIGITAL ENERGY SYSTEMS

INDUSTRIAL AND SYSTEMS ENGINEERING

- OPERATIONS MANAGEMENT
- OPERATIONS RESEARCH & MANAGEMENT SCIENCE
- INDUSTRIAL INFORMATION SYSTEMS
- TECHNOLOGY ENABLED INNOVATION
- AUTONOMOUS SYSTEMS

COMPUTER SCIENCE

- BIG DATA & MACHINE LEARNING
- PRIVACY PRESERVING COMPUTING
- VIRTUAL ENVIRONMENTS
- TOOLS FOR RELIABLE SOFTWARE DEVELOPMENT

TEC4ENERGY

TEC4INDUSTRY

TEC4SEA

TEC4AGRO-FOOD

TEC4HEALTH

LOW POWER MICRO SENSOR HUMAN IMPLEMENTABLE

For the first time in the Iberian Peninsula, a neurostimulator was implanted in epileptic patients with the contribution of partners at the Centro Hospitalar Universitário de São João. Afterwards, new techniques of systems synchronization and signal processing for the development of new neurostimulation therapies were developed using very low power implantable sensor. International collaborations with the department of Neurology of Ludwig-Maximilian University of Munich in Germany and the Neurology Department of the University of Tampere had resulted in a scientific paper.

NETWORKED INTELLIGENT SYSTEMS

TEC4HEALTH

UNCERTAINTY-AWARE DEEP LEARNING-BASED APPROACH FOR COMPUTER-AIDED DIAGNOSIS AND GRADING

A CAD grading system that supports the clinical decision and the assigned pathology grades by providing a medically interpretable explanation. This methodology was successively tested in grading Diabetic Retinopathy. A deep learning model for COVID-19 detection in X-ray images was also designed using a dataset containing the manual labels given by two radiologists, including intra and inter-observer variability, in 1.845 chest X-ray images.

NETWORKED INTELLIGENT SYSTEMS

TEC4HEALTH

LOGISTICS, TRANSPORTATION SYSTEMS AND MOBILITY

(i) Knowlogis was awarded the best digital project award in the Healthcare sector by Portugal Digital Awards; (ii) Novel models to estimate the emissions and other externalities of transport and mobility.

INDUSTRIAL AND SYSTEMS ENGINEERING

TEC4HEALTH

ASSET MANAGEMENT

Novel predictive and presctiptive models for asset management and reliability engineering to control the health status across the whole life cycle of the asset.

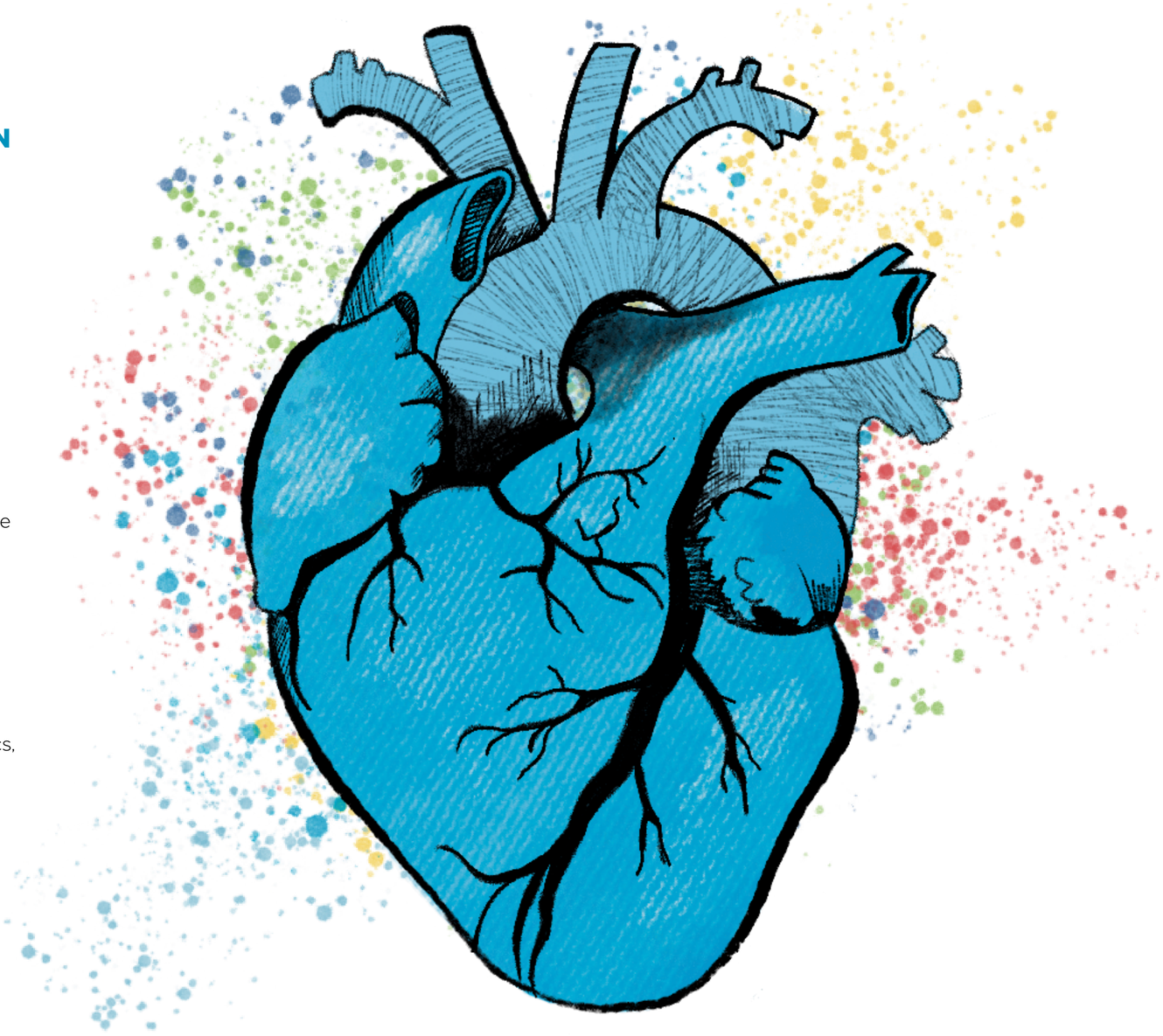
INDUSTRIAL AND SYSTEMS ENGINEERING

A REPOSITORY-AGNOSTIC SECURITY MIDDLEWARE

A repository-agnostic security middleware for a federated research environment for immunogenetics, to foster data sharing and joint research towards the development of new therapeutics and vaccines, providing a proof-of-concept implementation of a blockchain-based approach for the traceability of transformations used in the processing of human RNA data. Also a software ecosystem for the real time processing of geospatial data streams was implemented and tested, along with tools and methods for the assisted curation, exploratory analysis and publishing of large scientific datasets.

COMPUTER SCIENCE

TEC4HEALTH



3.3.2.
AFFORDABLE, SUSTAINABLE AND CLEAN ENERGY

PRIVACY-PRESERVING PROTOCOL AND DATA MARKET

Development of a privacy-preserving protocol and data markets for renewable energy collaborative forecasting, considering different communication schemes (centralized, peer-to-peer, asynchronous communication).

POWER AND ENERGY

TEC4ENERGY

AGENT-BASED MODEL

Development of an agent-based model to simulate the MIBEL day-ahead market considering the presence of hydro generation, wind and solar PV units.

POWER AND ENERGY

TEC4ENERGY

DEEP LEARNING APPROACH

Deep learning approach (variational auto-encoders) to simulate load profiles of residential consumers under dynamic electricity tariffs and demand response signals. Code released in Github and method published in IEEE Access.

POWER AND ENERGY

TEC4ENERGY

TECHNIQUES TO DETECT AND ISOLATE FAULTS

Development of techniques to detect and isolate faults in passive and active components of DC/DC power converters. This algorithm, based on an inversion method, is able to detect automatically failures in DC/DC converters.

POWER AND ENERGY

TEC4ENERGY

SEED PROJECT

Seed project to develop an innovative solution for provision of a virtual inertia in power inverters based on a controller of the voltage of the DC link capacitor, applied to photovoltaic systems.

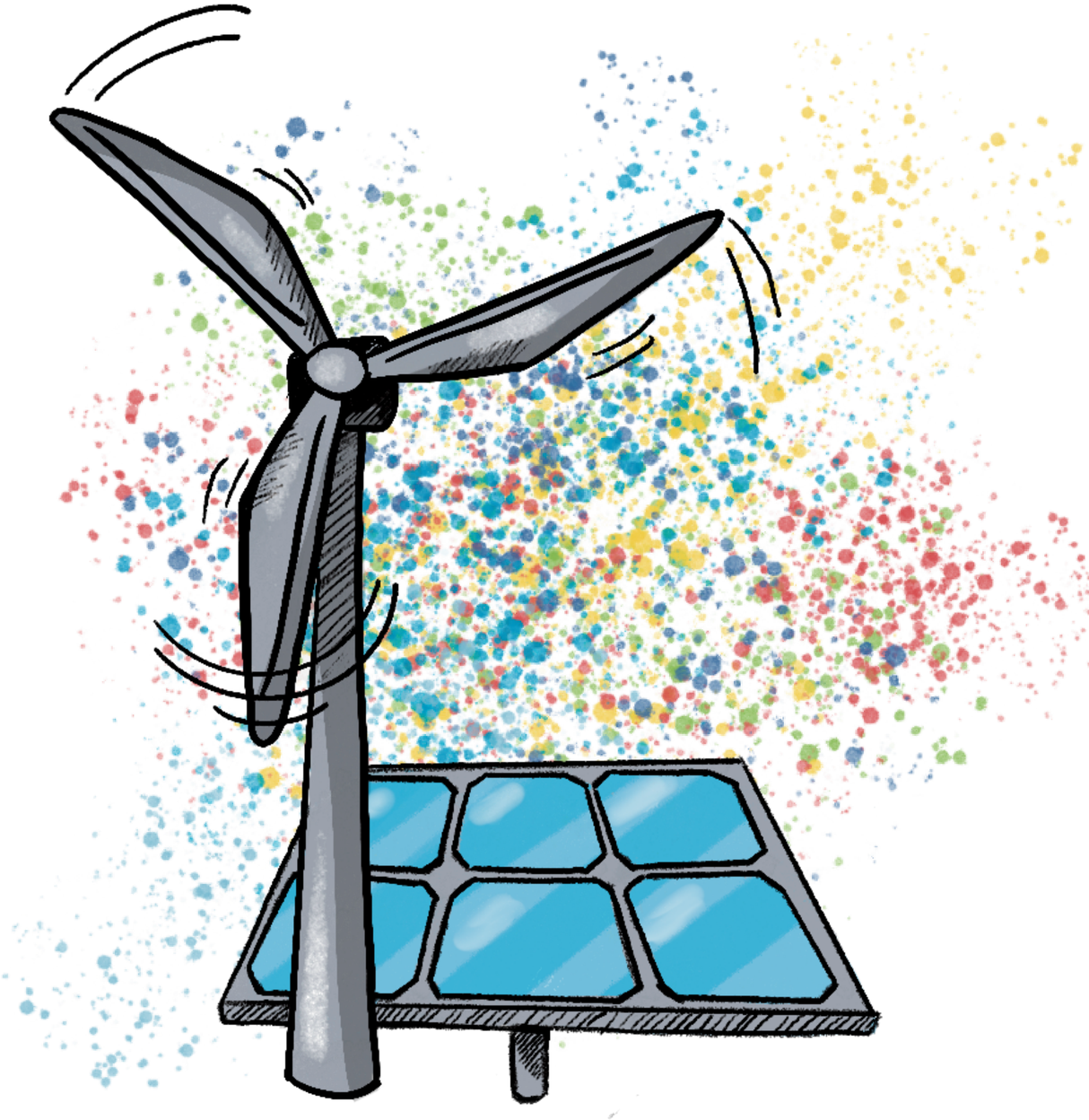
POWER AND ENERGY

METHODOLOGY TO MONETIZE THE BENEFITS OF THE INVESTMENTS IN THE DISTRIBUTION SYSTEM

Development of a methodology to monetize the benefits of the investments in the distribution system concerning the security of supply, the quality of service, the distribution losses and operational efficiency. The tool includes the estimation of the distribution grid quality indices evolution and assists the DSO on the medium and long-term planning decisions.

POWER AND ENERGY

TEC4ENERGY



DATA-DRIVEN METHODOLOGY TO PREDICT DISTRIBUTION LINES

Development and application of a data-driven methodology to predict distribution lines (overhead and subterranean) failure location in HV and MV networks operated by E-REDES, considering meteorological variables, geographical location, and physical characteristics (e.g. conductor material).

POWER AND ENERGY

TEC4ENERGY

A CROSS-ENTROPY OPTIMIZATION METHOD FOR SMART SCHEDULE OPTIMIZATION

Implementation of a cross-entropy optimization method for smart schedule optimization within domestic and tertiary buildings to be employed in distributed computational units (edge) and cloud-based systems.

POWER AND ENERGY

TEC4ENERGY

A POLYGLOT LAYER TO ENABLE INTEGRATED INTERROGATION OF DATA STORED IN DATA SOURCES

Building a polyglot layer to enable integrated interrogation of data stored in data sources with different NoSQL models through an extended relational model, thus being compatible with existing Low-Code development tools. The power grid can benefit from a holistic approach to query data from several database systems, where possibly each one addresses a distinct reality and thus deploy distinct data models types (relational, non-relational, graphs, etc).

POWER AND ENERGY

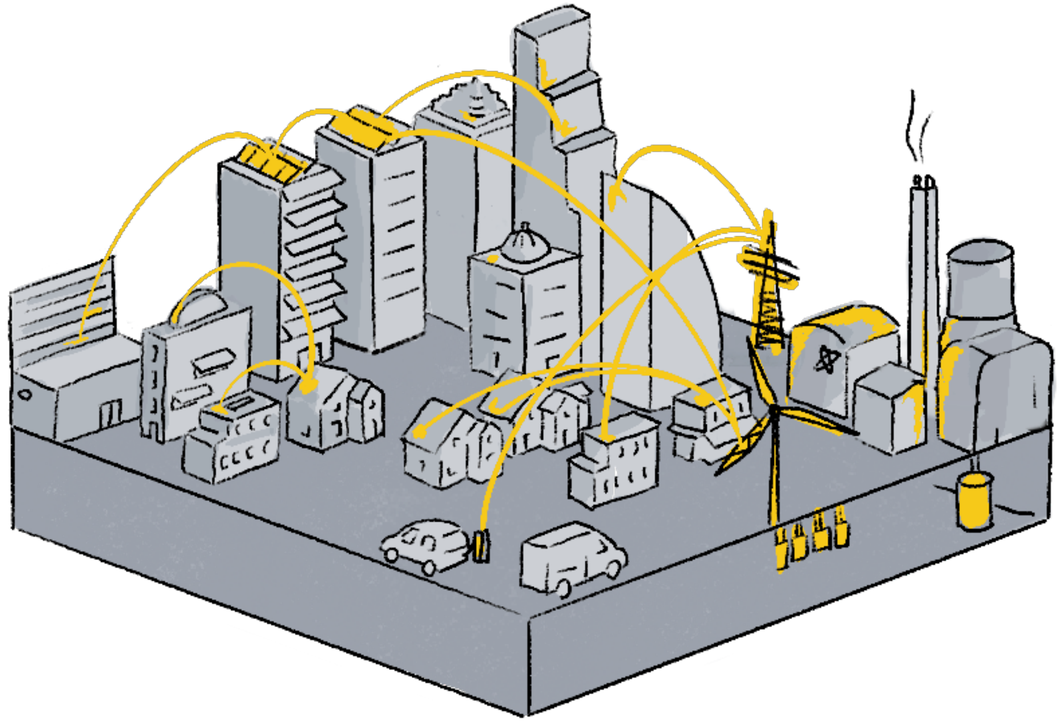
TEC4ENERGY

ANALYSIS OF THE IMPACT OF THE CHARACTERISTICS OF MESSAGE EXCHANGE PHASES

Analysis of the impact of the characteristics of message exchange phases in Byzantine fault-tolerant distributed settlement protocols, in particular, considering the use of cryptographic primitives, concluding that the approach to be followed in the construction of these protocols should include adaptation mechanisms. This work will be applied to the implementation of distributed Self Healing mechanisms to increase distribution network resilience.

POWER AND ENERGY

TEC4ENERGY



COLLABORATIVE APPROACH FOR DATA MONETIZATION AND IMPROVED EXTRACTION OF VALUE

Collaborative approach for data monetization and improved extraction of value, while being supported in distributed management solutions for control and auditability such as blockchain. This concept is being explored for the monetization of energy forecast data, benefiting from each other's data and collecting a profit based on data quality.

POWER AND ENERGY

TEC4ENERGY

INESC TEC SEED PROJECT P2PCHAIN

Development of a first prototype of a local market platform for energy trading based on Ethereum blockchain technology with an innovative post-delivery local energy market design.

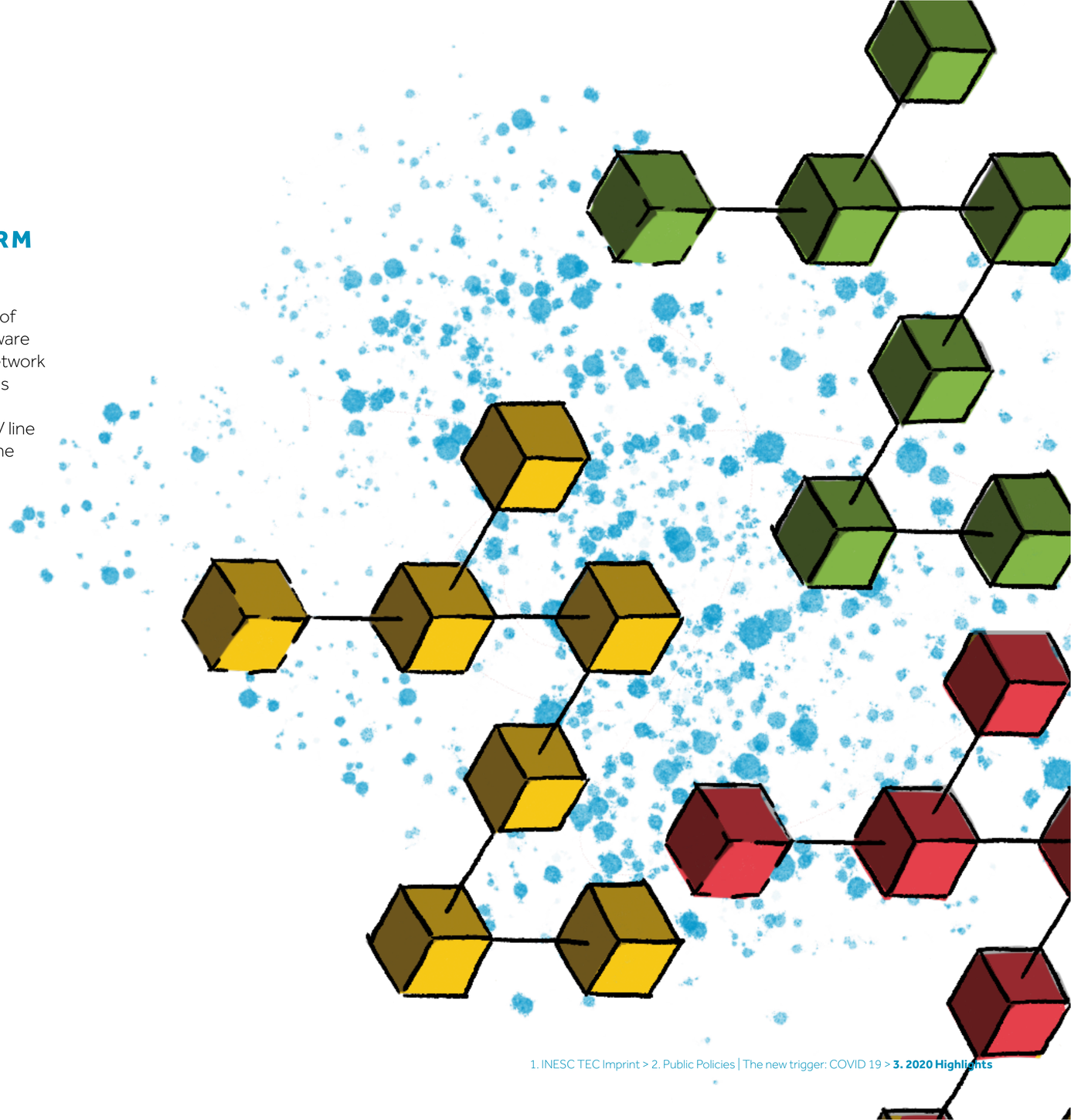
POWER AND ENERGY

HISTORICAL DATA OF AI-BASED SUBSTATION'S ALARM MANAGEMENT SOFTWARE

Development and validation with historical data of AI-based substation's alarm management software for reducing the cognitive load of distribution network operators, namely: 1) identification of anomalous behaviours regarding the performance of the protection functions associated with HV and MV line panels. 2) identification of similar events in HV line panels.

POWER AND ENERGY

TEC4ENERGY



3.3.3.
INNOVATIVE INDUSTRY AND INFRASTRUCTURE

OPTOFLUIDICS AND SENSING

The monolithic fabrication of an integrated device with femtosecond lasers for the excitation of whispery gallery modes through a suspended waveguide was demonstrated; the devices produced set the world state-of-the-art on silica machining and this solves the problems associated with the robustness of whispery gallery modes excited with fiber tapers. Waveguides operating in a broadband regime were also fabricated and were key to demonstrate the excitation of close-to-surface waveguides and plasmons, as well as its application in integrated optics sensing.

NETWORKED INTELLIGENT SYSTEMS

OPTICAL GRAPHENE MICROPHONE

Fabrication of graphene oxide thin films through dip coating technique was employed for the assembly of membranes in optical fibers for acoustic or pressure sensing. This deposition process allowed the development of ultrasonic sensors for broadband spectrum and were compared with a conventional microphone. The deposition technology is being adapted for the manufacture of graphene-based antennas in the GHz range. The study of graphene inks is also being explored for sensing applications.

NETWORKED INTELLIGENT SYSTEMS

PLACEMENT AND ACTIVE QUEUE MANAGEMENT ALGORITHMS FOR AERIAL NETWORKS

Placement and active queue management algorithms for aerial networks that enable significant performance gains (higher throughput and lower delay) when compared to state-of-the-art counterparts.

NETWORKED INTELLIGENT SYSTEMS

NEW TRACE-DRIVEN NS-3 SIMULATION MODELS

New trace-driven ns-3 simulation models, enabling the replication of experiments and the creation of wireless network digital twins by using information on signal-to-noise ratio, physical data rates, and wireless channel occupancy observed in the real-world.

NETWORKED INTELLIGENT SYSTEMS

UBIQUITOUS FRAMEWORK FOR HIGH-QUALITY AUDIOVISUAL PRODUCTION

An IoT-like approach capable of automating the operations carried out at professional audiovisual production studios.

NETWORKED INTELLIGENT SYSTEMS

PARALLEL IMPLEMENTATION OF K-MEANS ALGORITHM ON FPGA

A fully parallel implementation of the K-means algorithm on FPGA to optimise the system's processing time, a key enabler for real-time applications.

NETWORKED INTELLIGENT SYSTEMS

UNDERSTANDING THE DECISIONS OF CNNS

A novel in-model joint architecture to explain the decision of CNN classifiers was proposed. This architecture outputs not only a class label, but also a visual explanation of such decision, and can be used with any classifier.

NETWORKED INTELLIGENT SYSTEMS

PRODUCTION PLANNING AND SCHEDULING

Production Planning and Scheduling. (i) A real time scheduling engine integrated with an IIoT platform to monitor, detect and evaluate disturbances on plan execution, and suggest corrective measures; (ii) A standardized communication protocol of open-source reinforcement learning (RL) integrated with simulation models for decision support in in-house logistics systems.

INDUSTRIAL AND SYSTEMS ENGINEERING

TEC4INDUSTRY

COLLABORATIVE NETWORKS AND SUPPLY CHAIN MANAGEMENT

The balance of power dynamics between supply chain partners in the context of digital transformation of SMEs has been investigated in the winner project of the EurOMA Young Scholar Networking Grant.

INDUSTRIAL AND SYSTEMS ENGINEERING

TEC4INDUSTRY

2D/3D INDUSTRIAL VISION AND ADVANCED SENSING

Development of an AI empowered flexible robot handling system, capable of generating grasp solutions, based on the digital model of both the part and the gripper and their contact forces.

INDUSTRIAL AND SYSTEMS ENGINEERING

TEC4INDUSTRY

COLLABORATIVE ROBOT

(i) Deployment of a collaborative robotic coating cell. This industrial cell includes a programming by demonstration system, an advanced 3D sensing system, and an innovative safety sensor to allow for a symbiotic, safe and intuitive human-robot collaboration. (ii) An automated framework (AdaptPack studio) for agile development and simulation of robotic palletizing cells.

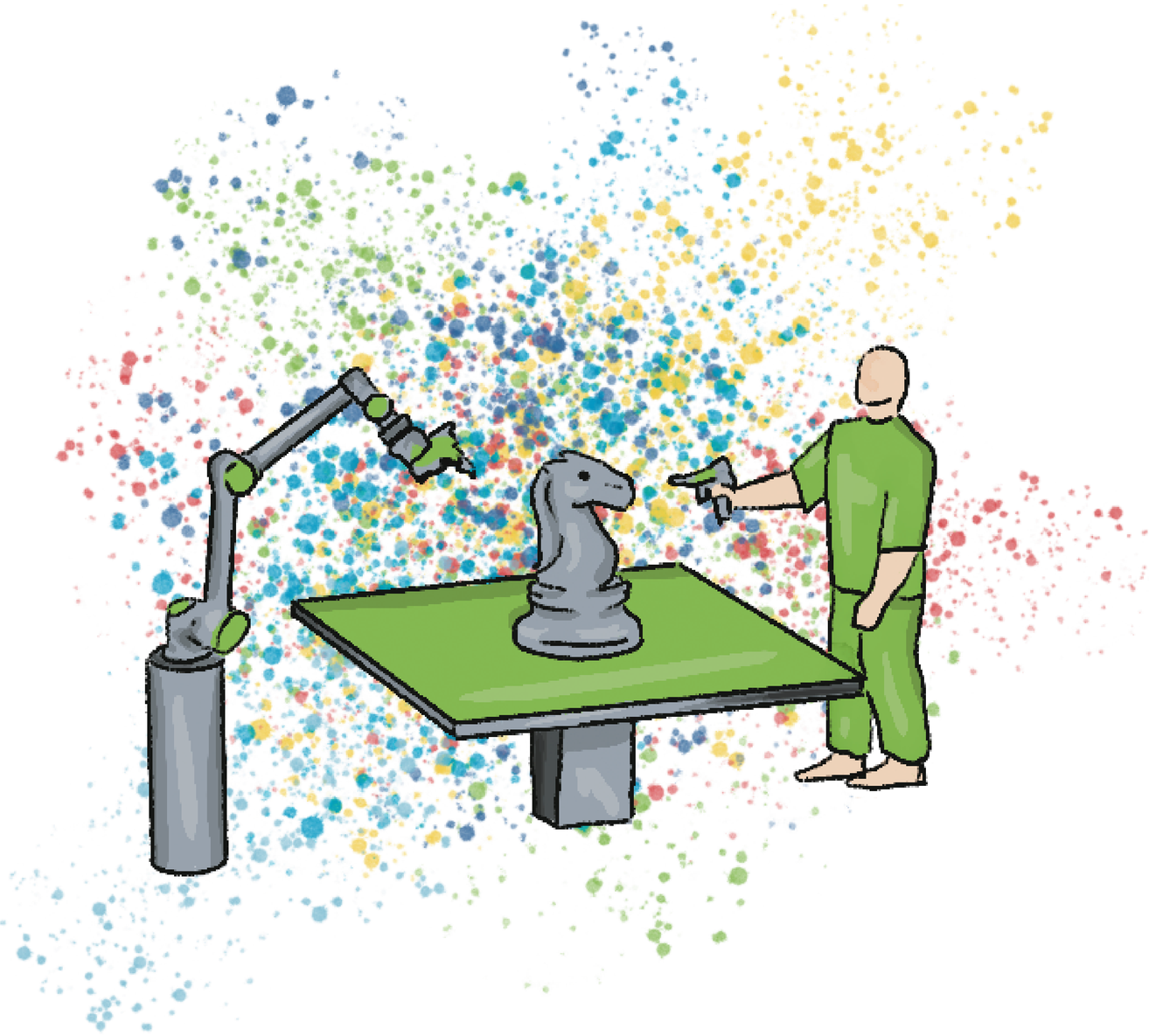
INDUSTRIAL AND SYSTEMS ENGINEERING

TEC4INDUSTRY

FIRST SPECIFICATION OF A DIGITAL PLATFORM

A first specification of a digital platform based on semantic-enabled architecture to manage product-service systems based in the concept of digital twin was achieved.

INDUSTRIAL AND SYSTEMS ENGINEERING



EXPANSION OF THE OSPS (OPEN SCALABLE PRODUCTION SYSTEM) FRAMEWORK

Expansion of the OSPS (Open Scalable Production System) framework through the integration with robotic oriented cloud computing platforms (allowing for large scale testing and deployment of multi robot systems), namely the Amazon AWS RoboMaker, together with Manufacturing Execution System and Simulation and Decision Support Tools.

INDUSTRIAL AND SYSTEMS ENGINEERING

PLATFORM FOR COMPUTATIONAL OFFLOADING

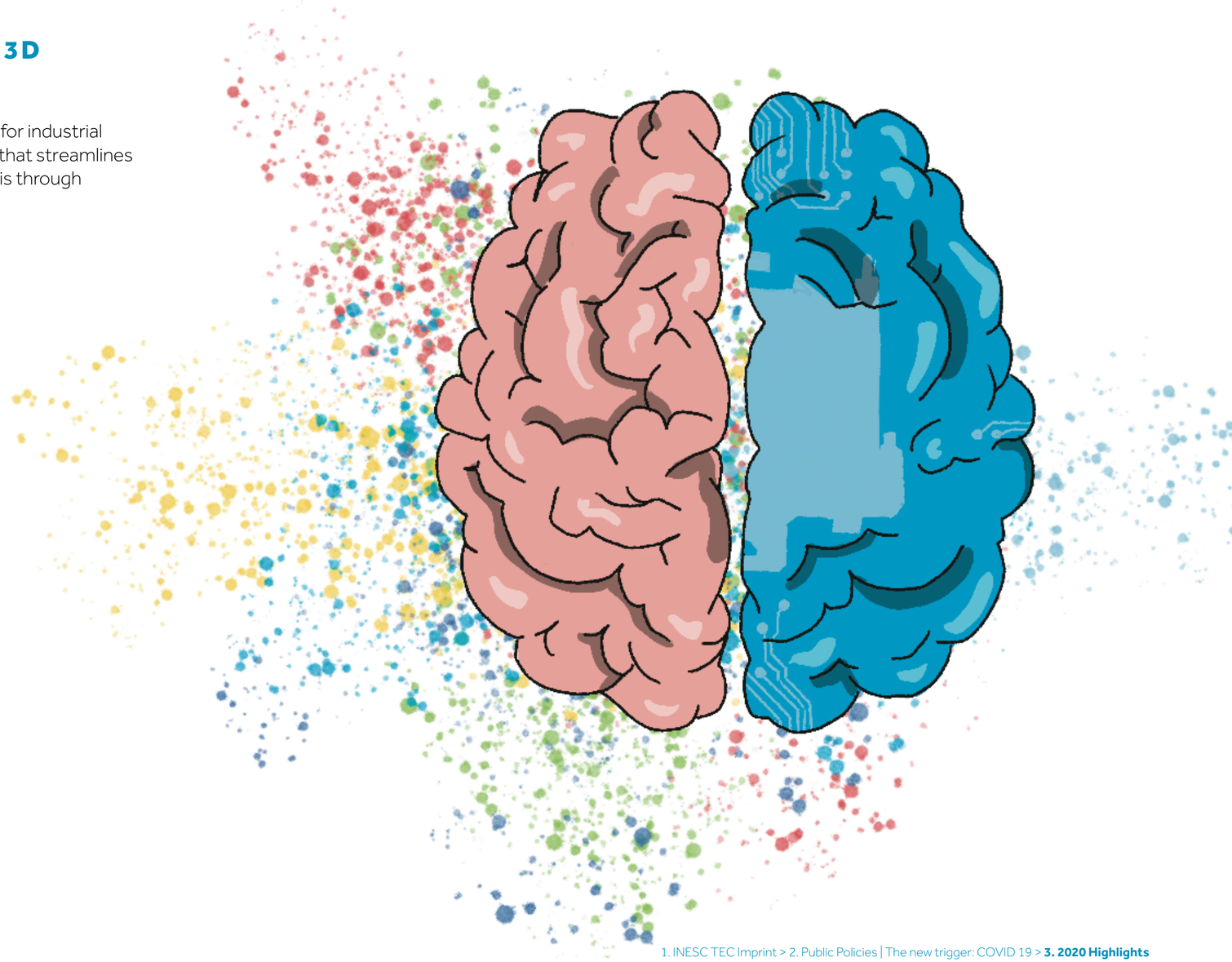
Advances on a platform for computational offloading include the possibility of using soft real-time tasks and off-loading algorithms that take deadlines, execution time, local and total energy consumption into account.

COMPUTER SCIENCE

A FULLY IMMERSIVE 3D AUTHORING TOOL

A fully immersive 3D authoring tool for industrial training, a joint project with Vestas, that streamlines 3D authoring and enables its analysis through automated techniques.

COMPUTER SCIENCE



3.3.4.
ENVIRONMENT ACTION (BELOW WATER AND ON LAND)

IMPROVED 3D VISUAL INFORMATION FOR UNDERWATER MANIPULATION

Improved 3D visual information for underwater manipulation based on the innovative hybrid imaging system for 2D/3D visual acquisitions for harsh underwater environments. New operational regimes and the capability to provide dense 3D measures for textureless scenarios were included.

NETWORKED INTELLIGENT SYSTEMS

TEC4SEA

AUTONOMOUS NAVIGATION

Deep learning algorithm for underwater visual odometry navigation. This algorithm fuses together visual and inertial data, using a recurrent neural network.

NETWORKED INTELLIGENT SYSTEMS

TEC4SEA

UNDERWATER DOCKING

A multi-sensor system for underwater docking operations; this system combines short-range acoustic positioning with visual perception, allowing for a global solution of the relative localization problem in underwater docking maneuvers.

NETWORKED INTELLIGENT SYSTEMS

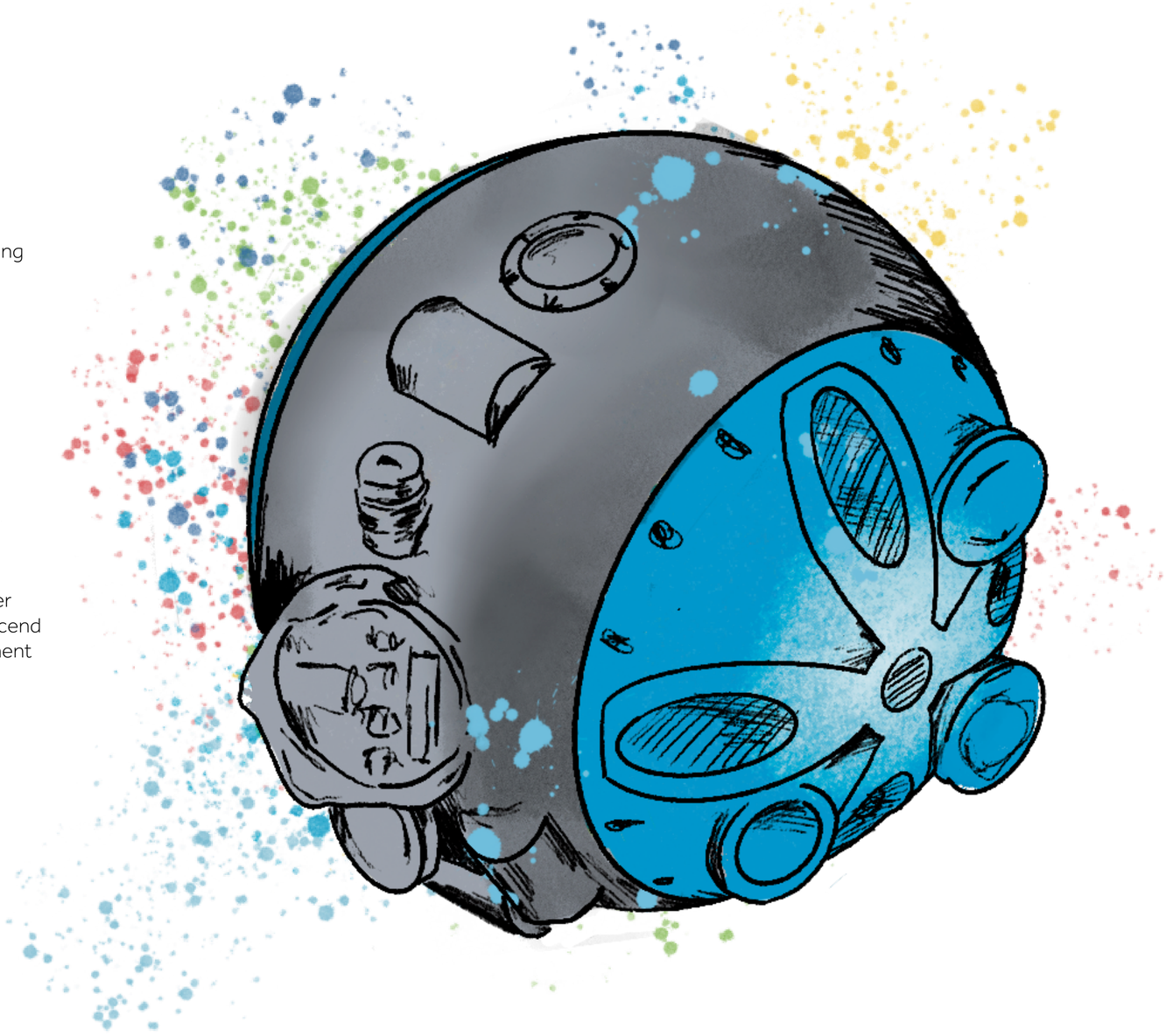
TEC4SEA

AUTONOMOUS WATER SAMPLER

An autonomous sampler of the water column for estimation of sediment transport. Based on the real time estimation of sensor depth, and on the modelling of the deployment system, this sampler assures that the water sampler descends and ascend on the water column at constant rate, a requirement for transport sediment estimation.

NETWORKED INTELLIGENT SYSTEMS

TEC4SEA



PRECISE POSITIONING

Development and implementation of algorithms for precise positioning both above (RTK GPS) and under water (acoustic based). These algorithms enable the precise space referencing of data collected by robotics platforms, contributing to the production of accurate maps of surveyed areas.

NETWORKED INTELLIGENT SYSTEMS

TEC4SEA

NAVIGATION, LOCALISATION AND COORDINATION OF MOBILE ROBOTS

A novel open-source Path Planning solution Aware of Robot's Center of Mass for Steep Slope Vineyards.

INDUSTRIAL AND SYSTEMS ENGINEERING

TEC4AGRO-FOOD

INNOVATIVE HDR IMAGE PIPELINE

Development of an innovative HDR image pipeline that enables object recognition in extreme lighting conditions, as the major outcome of project HDR4RTT, a project funded by the U.S. Office of Naval Research Global.

COMPUTER SCIENCE

3.3.5.
PARTNERSHIPS FOR THE SUSTAINABILITY DEVELOPMENT GOALS

FAKE NEWS DETECTION

(i) a novel process to identify bots; (ii) a model to balance the need for information regarding volume and time; (iii) ML models for tampered videos and photos; (iv) external modules for the widely used and open-source Autopsy tool.

COMPUTER SCIENCE

PRIVACY-PRESERVING DATA STORAGE

Advances in privacy-preserving data storage and processing include the development of a secure data analytics framework that enables the combination of different cryptographic primitives with hardware-based protected environments, namely for Machine Learning workloads, with the goal of protecting both data and models when using third-party infrastructures. A secure deduplication system that takes advantage of hardware-based protected environments has also been developed.

COMPUTER SCIENCE

PROPERTY-BASED TESTING FRAMEWORK

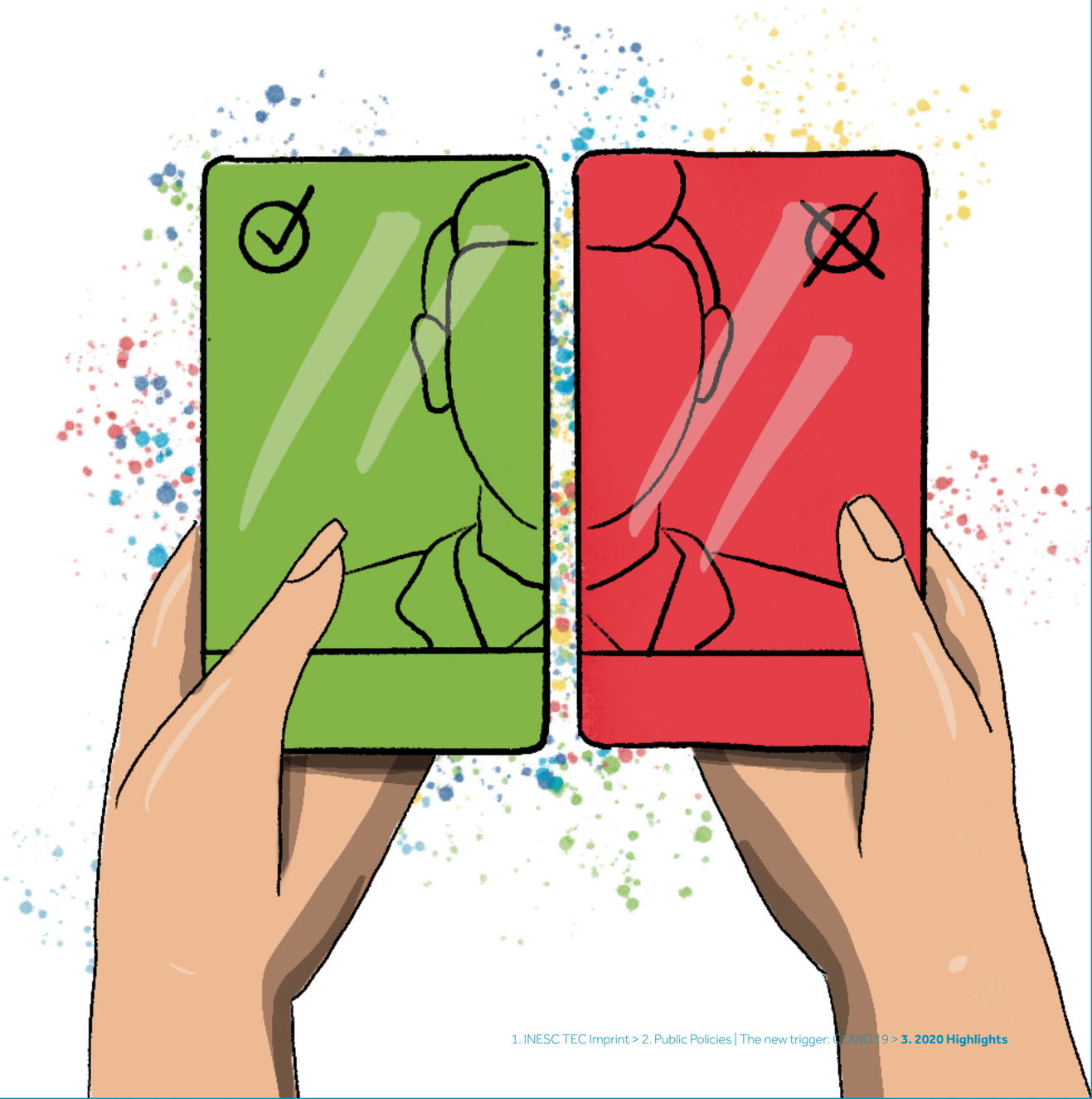
A property-based testing framework for assessing the correctness of smart contracts in the Ethereum blockchain was developed.

COMPUTER SCIENCE

TECHNOLOGY ENTREPRENEURSHIP

A novel reference framework for Software as a Service Business Model Creation.

INDUSTRIAL AND SYSTEMS ENGINEERING



EUROPEAN PROJECT COORDINATION (PROJECT TRUST-AI)

European project coordination (Project TRUST-AI), selected for funding; the project builds on Genetic Programming.

INDUSTRIAL AND SYSTEMS ENGINEERING

SCIENCE MATHEMATICAL PROGRAMMING-BASED HEURISTICS

New insights were obtained on how to deal with uncertainty and hybridize heuristics and mathematical programming (matheuristics). These approaches have been applied on emerging topics related to urban logistics (in particular "last mile").

INDUSTRIAL AND SYSTEMS ENGINEERING

VISUALISATION TECHNIQUES

Novel semantic ontologies to recommend the adequate visualisation techniques for a given analytical task when analysing urban mobility data, with deep learning artificial neural networks.

INDUSTRIAL AND SYSTEMS ENGINEERING

THEORY OF SERVICE DESIGN

(i) Co-creation and launch of the ServCollbab, a global initiative of service researchers to improve well-being; (ii) new results in advanced service design and innovation for healthcare transformation and technology startups; (iii) advanced the understanding of customer experience with technology enabled services.

INDUSTRIAL AND SYSTEMS ENGINEERING

4

A tenet made of people

4.1.
An incredible team


Ana Filipa Sequeira
CTM


André Coelho
CTM


Artur Capela
CSIG


Bruno Veloso
LIAAD


Cândido Duarte
CTM


Cristina Barbosa
CITE


George Santos
CPES


Gonçalo Figueira
CEGI


Hélder Castro
CTM

Hélder Fontes
CTM


João Pinto
CTM


Jorge Santos
SGI


José Paulos
CPES


Leonel Oliveira
CPES


Leonor Oliveira
RH


Luís Rocha
CRIIS


Pedro Carvalho
CTM


Pedro Jorge
CAP


Sara Oliveira
CTM


Vera Pinto
SRI/UTAustin

INESC TEC is a challenging place to work, ideal for self-improvement, providing a multicultural, international and collaborative environment that makes it easier to exchange ideas, network and create synergies.
Acknowledging itself as a true community, INESC TEC recognises monthly exceptional performances that exceed regular activity by highlighting individuals as "**The Incredibles**".

4.2.
Our colleagues

... our creative ability to adapt and jointly create new pathways to drive innovation and research, to cherish our collaboration and to nurture hope in all scenarios. It is with deep gratitude that I have witnessed the appearance of so many projects an initiatives - both internal and external - focused on the common good, serving our society, putting our skills, minds and resources seeking solutions.

Cristina Barbosa

... our effective and flexible response to change and uncertainty. In my view, this is proof that resilience is always due to the way we respond to what is happening.

André Coelho

... the truly remarkable and inspiring way in which INESC TEC adapted to the challenging reality experienced in 2020! Particularly, with its fast realignment of the ongoing projects, simultaneously with the generalized INESC TEC community engagement in solving concrete pandemic related problems and with effective value delivery to society.

Catarina Marques

... the resilience and adjustment capacity to a new and demanding reality. We stayed at home and become virtual. We have created and learned new tools to work, share, and communicate. Due to the tenacity and commitment of each individual that makes up this community, it was possible to maintain the activity level, and most importantly, the quality of what we make.

Vera Pinto

... how vulnerable we are and how easily everything can be flipped upside down.

Katarzyna Gdowska

.... the institution's ability to promptly adapt the working format and the way of providing support to its workers, facing the adversities that substantially affected us all in 2020: INESC TEC knows how to continuous and effectively maintain the activities, prioritizing at the same time the safety and care to the employees, standing by them with very important support. For me, the spirit that we have and can count on each other is one of the essential driving forces for the institution, and, more than ever, this was reaffirmed in 2020.

Everton Alves

... not being able to be at INESC TEC during that year, due to the pandemic situation. However, me and my group made a combined effort to maintain normality in the face of such an abnormal situation. I realized that INESC TEC goes far beyond its walls and that team spirit, even if virtual, is stronger than any pandemic.

Elodie Lopes

... seeing the adaptability and resilience that we all show in facing the impact of the pandemic on our work routine.

Lino Oliveira

... the ability to overcome the adversities imposed by the confinement and, at the same time, the willingness to contribute to the needs of our country, by serving the public interests with the development of the STAYAWAY COVID app. In such an overwhelming year, I also feel that INESC TEC made an undoubted effort to take care of its own, strengthening our sense of belonging. Thank you INESC TEC!

Susana Silva

... the paper reducing in a department where we dealt with it daily, due to the newest challenges.

Fátima Teixeira

... how much we were able to keep learning and growing as researchers, both individually and as a team, even despite such trying times for our motivaton and mental health. Life threw its very best curveballs but we kept knocking them out of the park.

Bernardo Teixeira

... undoubtedly the solidification and the ability to adjust to all the dynamic changes that happened throughout the year due to the COVID-19 circumstances, as well as the support capacity of its different services. INESC TEC continued to provide knowledge sharing and various networking opportunities through quality virtual event initiatives and the opportunity to participate in various projects.

Vanessa Silva

... how quick the teams adapted to a fully remote environment and how they formed a united front to face the challenges raised by such a change. Thanks to everyone for doing such remarkable work!

José Pedro Ornelas

... how fast we, as an organization, adjusted to a different reality, kept the same team spirit, and still managed to make timely and significant contributions.

Ana Alonso

... people's resilience. Despite the pandemic context, our community was able to improve working methods, innovating and promoting excellence in science, while seeking solutions to solve global pandemic challenges.

Paula Rodrigues

... how well everyone was able to adapt to the deep changes in life that we all suffered and seamlessly created ways to help researchers continue their work.

Américo Pereira

4.3.
Our partners

... enhance our grids to fully decarbonize our energy system. Innovation in grids, through increased flexibility and digitization, is a key part of EDP's strategy to become "All Green by 2030" which envisages a sustainable world, powered by renewables. INESC TEC is a core technical partner helping us achieve our ambition.

Miguel Stilwell d'Andrade, Chief Executive Officer, EDP

... enter a new area, outside the core business area of Wavecom and with enormous potential, High Performance Computing, with the BigHPC project that combines Big Data with HPC infrastructures.

José Ferreira, co-CEO, Wavecom

... ask the right research questions.

João Abril de Abreu, Innovation and University Relations Manager, Outsystems

... jointly conceive and promote ideas that might improve life in society.

Gonçalo Caseiro, Chair, INCM

.... provide better care to our patients through innovation.

Rui Henrique, Chairman of the Board of Directors, IPO

In 2020 INESC TEC challenged us to ...

... rethink our approach to Industry 4.0, focusing on fragilities of the bottom layers of the Automation Pyramid.

Luís Ferrete, Project Engineering, Amorim

... increase the differentiation of the solutions we provide to our customers, specifically on the areas of predictive management of renewable sources. Furthermore, we have partnered to codevelop solutions that promote sustainable energy communities and increase the flexibility when operating distribution grids. Also for smart cities, we are working closely together on holistic platforms to promote better citizen experiences when using several urban infrastructures. Even during an atypical and challenging year, the pandemic did not stop us from feeding our people with interesting challenges. INESC TEC has been a long standing partner for Efacec in creating value and also enriching the knowledge base for both parties. This is definitely a win-win sustainable industry-academia cooperation.

Ângelo Ramalho, CEO, EFACEC

... submit to the Portugal Digital Awards the result of our most recent partnership: the project KnowLogis. It was with great enthusiasm that we all get to know that the innovative project developed with the Centro Hospitalar Vila Nova de Gaia / Espinho won the Best Healthcare Project Award!

Ricardo Gil, Head of Business Consulting Healthcare and Advanced Analytics, Glintt

... go beyond SCALABLE 4.0 project – a H2020, 42 month consortium project, successfully concluded in June 2020 - and to continue to aim high with developing in-house research and development, a cornerstone in SARKKIS-Robotics past and future activity.

José Oliveira, Manager, Sarkkis

INESCTEC

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FUNDING INSTITUTIONS

FCT Fundação para a Ciência e a Tecnologia

FITEC Fundo de Inovação, Transferência de Tecnologia e Economia Circular

PI PROGRAMA INTERFACE

Programa Nacional de Reformas

REPÚBLICA PORTUGUESA