

General Evaluation of the Institute 2018-2021

Information Technologies Institute
Centre for Research & Technology Hellas (CERTH)

Evaluation Committee

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1. General assessment of the Institute’s performance and its standing in the international scene

The Information Technologies Institute (ITI) was founded in 1998 as a non-profit research organization, under the auspices of the General Secretariat of Research and Innovation (GSRI) of the Greek Ministry of Development, and has been a founding member of the Centre for Research and Technology Hellas (CERTH) since 2000.

ITI’s head office is located within CERTH premises, while it currently expands over another four buildings (including the near-Zero Energy Building Smart Home research infrastructure) in the broader region of Thessaloniki, Greece, and three subsidiaries in Volos, Athens, and Ioannina, respectively.

The main scientific and research orientation of ITI has originally been on the fields of image processing, computer vision, multimedia analysis, and 3D technology. Currently, activities have expanded significantly to include Artificial Intelligence (AI) and Machine Learning (ML), video and 4D processing, Information Retrieval (IR), Social Network and Web analysis, Human Computer Interaction, Virtual and Augmented Reality, Assisted Living, IoT and wearables, e-health and personalised medicine, additive manufacturing, privacy and security, robotics, geosciences and remote sensing, ICT networks and communications, e-government and policy modelling, smart home/cities, and cultural and educational technology.

ITI consists of seven core laboratories (Virtual & Augmented Reality Lab; Visual Analytics Lab; Visual Computing Lab; Cognitive Systems & Robotics Lab; Multimedia, Knowledge and Social Media Analytics Lab; Communications & Networking Lab; and Intelligent Digital Transformation Lab), supported by two major research infrastructures (Smart Home Facility Research Unit and Additive Manufacturing Research Unit). ITI’s personnel comprises (end of 2021) 549 people, including 19 permanent researchers – a growth of 70% during the reporting period (2018–21). It is notable that, during the past three years, the core research team of ITI has seen the addition of more permanent researchers than in the previous 20 years since the Institute’s foundation.

ITI’s organisational structure is depicted in Figure 1 below. The Institute has a Director and is governed by the Scientific Council, which currently comprises seven members with representation from the research and technical and administrative personnel. The *Supporting Services Sector* includes the *Management & Organization Services Unit* and the *Technical Support Unit* that offer administrative and technical support to ITI personnel, while the two research infrastructures reside under the *Research & Development sector*, together with the seven core laboratories that are further structured under the *Computational Perception and Interaction (VARLab, VALab, VCL, Robotics)* and *Multimedia, Networks & e-Services (MKLab, CNL, IDT Lab)* (sub-)sectors.

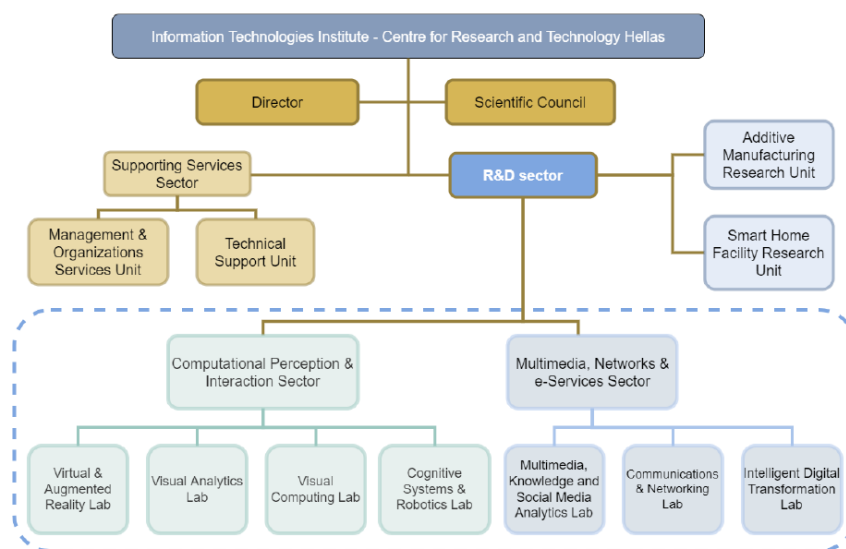


Figure 1: ITI organogram

ITI has seen tremendous success and growth in recent years despite the unfavourable economic climate in Greece and internationally, following the economic recession and the Covid-19 pandemic. The Institute ends up the reporting period with 549 total personnel at the end of 2021, 70% up from the 322 personnel in 2018, with the vast majority of this growth reflecting the increasing success of the Institute in attracting competitive research funding. The fact that the Institute has managed to accommodate such expansion under such short timescales and difficult global circumstances testifies to its excellent management and governance structure, and its visionary leadership.

ITI is one of the top-ranked interdisciplinary research institutes in Europe and has substantially contributed in CERTH ranking 14th in research income (>€171m Net EU contribution) across all H2020 Research (REC) participants, and top (ranked 1st) H2020 participant from Greece across all Legal Entity Types, with 28% higher net EU contribution from the second¹. For every €1 of regular budget ITI receives from the Greek government, it attracts a further €41 from EU and national competitive grants and private contracts.

To put research income in context, ITI has had an average research income generation of ca €19m per annum from competitive grants throughout the reporting period 2018–21. Considering the 19 Full Time Equivalent (FTE) permanent research personnel of the Institute at the end of 2021, the total average figure corresponds to €1m per permanent research FTE per annum. As an indication of the extraordinary performance of ITI in research income generation, it is worth noting that, for example, the 90th percentile for research income generation per academic FTE in 'IT, systems sciences & computer software engineering' across the Russell Group of the top, research-intensive Universities in the UK is ca £189k (ca €228k) per annum².

During the reporting period, ITI researchers have co-authored 927 publications that have attracted more than 19,000 citations. In terms of scientific excellence, over half of the Institute's journal publications, every year, appear in Q1 journals. Research outputs published by ITI in all subject areas during the latest fully indexed five-year period 2016–2020³ have an overall Field-Weighted Citation Impact (excl. self-citations) factor of 2.24 on Elsevier's Scival benchmarking suite⁴, indicating that research outputs from the Institute are cited well over 100% more than world average. Indeed, ITI ranks higher than any other Greek Research Institute in Informatics and relevant areas or Research Centre hosting such Institutes that is indexed by this platform (cf Table 1).

Research Institute	Field-Weighted Citation Impact (excl. self-citations)					
	Overall	2016	2017	2018	2019	2020
Informatics and Telematics Institute (ITI)	2.24	2.4	0.82	1.74	1.39	8.61
Institute of Communications and Computer Systems	1.42	1.29	1.21	1.23	1.43	1.86
Demokritos National Centre for Scientific Research	1.4	1.27	1.44	1.32	1.43	1.55
Foundation for Research and Technology-Hellas	1.13	1.09	1.15	1.18	1.1	1.12
Center for Research and Technology - Hellas	1.1	0.86	1.23	1.27	1.04	1.11
Athena Research and Innovation Center in Information, Communication and Knowledge Technologies	1.07	1.87	0.95	0.83	0.72	0.55
National Hellenic Research Foundation	0.83	0.72	1.06	0.81	0.63	0.92

Table 1: Field-Weighted Citation Impact (excl. self-citations) in all subject areas of Hellenic Research Institutes in Informatics and relevant disciplines, and Research Centres incorporating such Institutes based on All Science Journal Classification (ASJC), 2016–20; source <https://www.scival.com/benchmarking/analyse> (accessed 22/07/2022)

¹<https://webgate.ec.europa.eu/dashboard/sense/app/93297a69-09fd-4ef5-889f-b83c4e21d33e/sheet/PbZJnb/state/analysis>

² https://www.gla.ac.uk/media/Media_831744_smxx.pdf

³ 2021 and 2022 still being indexed and hence appear as incomplete at the time of writing

⁴ Benchmarking platform used by many research and higher education institutions across the world for capturing output performance metrics to report in research assessment exercises, including the UK Research Excellence Framework 2021.

The Institute contributes significantly to training and educational activities, through the joint supervision of PhD/MSc/diploma students (>110 during the reporting period), visiting professorship appointments for ITI researchers, participation in European education and training programmes, the hosting of interns from Greek and European Universities, and the organisation of numerous educational seminars (or webinars), workshops, and hackathons.

During the reporting period, ITI researchers have filed for three (3) patents and created six (6) spin-off companies, while sustaining commercial activities in another four (4) companies spun off ITI before 2018. To put the magnitude of these wider impact achievements (Intellectual Property generation and commercialisation) in context, it corresponds to, approximately, one IP generation or commercialisation activity for every 2 permanent researcher FTEs during the reporting period 2018–21. For comparison, for the UK 2021 Research Excellence Framework (7-year-period research assessment for all UK Universities), a Unit of Assessment of equivalent size to ITI (up to 19.99 FTE) was required to submit only two (2) Impact⁵ Case Studies in total⁶.

In all dimensions of activity examined and summarized above, the committee has found ITI to operate at the forefront of Science and Technology in Informatics with its leading contributions and standing (both institutionally and also of individual researchers) being widely recognized by the international scientific community, and also evidenced by the absolute and relative scoring in numerous performance indicators across all main dimensions of activity, both nationally and internationally.

⁵ Impact is defined as an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia

⁶ https://www.ref.ac.uk/media/1447/ref-2019_01-guidance-on-submissions.pdf

2. Evaluation of the infrastructure and the operation of the Facilities. Comments on planned developments

2.1. Overview

ITI boasts an impressive research infrastructure, appropriately supporting the activities of all research labs, including

1. High-performance computing infrastructure
2. An extensive collection of devices in support of virtual and augmented Reality research
3. Numerous robots and drones
4. Wearable brain-machine devices
5. Wired/Wireless Networking and 5G Infrastructure
6. Infrastructure for circuit designing and prototyping
7. Imaging and visual computing devices, and
8. An impressive smart home, which is quite unique (internationally) in its design and embedded devices.

This infrastructure, having been acquired through research grants, is evidence to ITI's research excellence, while, at the same time, enabling the experimental work necessary for future high-impact research.

Compared to the research infrastructure, space appears to be at a premium, given the expansion of the number of ITI researchers in the past few years.

2.2. Infrastructure and Operation of Facilities

The [nZEB Smart House](#) is an impressive living lab, at the core of (a) numerous publications and (b) the IsZEB Cluster [www.iszeb.gr] (full title: Intelligent Solutions for Zero & Positive Energy Buildings – Digital Innovation Hub), an interdisciplinary R&D activity involving academics and industry. This facility and the research activity around it is an exemplar for many international IoT/Construction/Digital Twins projects.

The Additive Manufacturing Unit (AMU) provides its facilities and equipment for the manufacturing and examination of 3D printed prototypes and other more mature products before their market launch. AMU is equipped with 3D-Printers, 3D-Scanners and Non-Destructive quality control tools which allow fabrication on proof-of-concept prototypes, while its complete software platform allows addressing the entire pipeline from concepts and drawings to structured models and designs that lead to end products actual look-and-feel.

2.3. Planned Development

The new building will be an excellent addition to ITI; it will relieve the space pressure and its innovative and creative design will enable productive collaborative research.

It is not clear where exactly all the above equipment is stored and how easy it is to access, but it may be a good idea for ITI to consider a lab management system for managing all this equipment and enabling all ITI researchers as well as University colleagues to use this equipment in order to amplify its impact.

The EKETA 2.0 project is the most important opportunity for ITI in the near future. With the support of around €10M from the European Investment Bank (EIB) and National funding, ITI will construct two new buildings: 1,340m² in Technopolis and 4,940m² in ThessIntec, including high-end equipment relevant to ITI's scientific directions.

3. Evaluation of the recruitment practices, operational and financial management

3.1. Recruitment practices

Recruitment practices at ITI are underpinned by the acknowledgement that its human resources are one of the most crucial factors for its success. ITI has undersigned the principle of the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers, and it was the first Greek recipient of the HR Excellence in Research Award. ITI follows CERTH's awarded HR strategy for managing its human potential.

Personnel recruitment for the different job families in ITI follows the corresponding national legislation and legal commitments of CERTH towards National and European laws, while respecting any additional specificities as these may arise from the contracts (e.g. Grant Agreements, Consortium Agreements, private contracts) that CERTH has signed and within which the employee will perform.

The staff selection processes and procedures for both temporary and permanent staff, including evaluation criteria, competent bodies, etc. are specified in national and European legislation and they are publicly available. ITI abides by these rules and respects possible additional requirements stemming from the contracts (e.g. Grant Agreements, Consortium Agreements, private contracts) that govern the function that the employee to be hired is expected to perform. All openings are announced on both ITI's and CERTH's websites and on the government's competent platform (Diavgeia). Openings for permanent research staff are additionally announced in national and international journals and on the EURAXESS portal. The announcements include two kinds of qualifications, namely necessary and desired. A candidate must fulfill all the former to be evaluated, whereas the latter serve as ranking criteria. All evaluations are conducted according to the set procedures; they may include interviews, and they are carried out by committees per project/contract. These comprise mostly senior researchers with expertise relevant to the project/contract and are normally chaired by project manager where the employee will work. Following the deliberations of the committee, the decision is communicated to CERTH's legal department that checks it against all pertinent legislation and rules. In case of non-compliance, the decision is returned to the committee for a re-iteration. When approved by the legal department, the decision documents are finalized and signed by the committee members and are subsequently forwarded to the director of the Institute for approval, registration, and publication in the government platform Diavgeia that is accessible by the public.

These policies and procedures are followed throughout, they are transparent and fair and, together with ITI's overall HR management policies and excellent working environment have rewarded ITI with a reputation of an attractive employer. The staff that the evaluation committee met were all enthusiastic, dedicated, and committed to ITI.

At the end of 2021, ITI had 549 employees, including 19 permanent researchers. It is worth noting that of these permanent researchers, 9 were hired before 2018 and 10 were hired between 2018-2021. This has to a large extent been made possible by a change in the legislation that allowed ITI to use own funds to finance permanent researcher positions. ITI intends to continue the currently followed successful recruitment practices to further increase its human capital, to address the increased need in human resources that result from its increasing research activity.

3.2. Financial management

ITI's income sources are, in order of contribution to its total income, the EC's R&I programmes (78% of the total income); national competitive R&I programmes (11% of the total income); private contracts (5% of the total income); and state financing through the state budget (2% of the total income) and the matching funds mechanism (3% of the total income). During the evaluation period, ITI attracted €76.41M from competitive national and EU research grants and private contracts and received only €4.62M from the Greek government. This is an impressive ratio, and ITI is certainly to be commended on this achievement.

The main expenditure during the evaluation period was salaries for non-permanent (83.21% of the total expenditure) and permanent (3.14% of the total expenditure) ITI staff. The remaining expenditure went to instruments and maintenance (5.72% of the total expenditure) and travel (3.39% of the total expenditure).

ITI follows CERTH's overhead policy. The overheads of each project are allocated to a project managed by the project manager(s). CERTH Central Administration charges 10% of the total project budget. If needed, ITI may request an additional charge (in the form of percentage on overhead) for general expenses; this option has not been exercised by ITI to date. In case of a negative balance of a project, the deficit has to be covered by the Laboratory running the project or, following internal agreement, through lending by another Laboratory.

All laboratories, facilities and Support Units provide services on demand. The pricing mechanism depends on the provided service, contract, etc. In some cases, an indicative pricing catalogue has been created, that includes most of the products/services offered. A combination of pricing methods is used, the main methods being "Cost per man-hour" and "Cost per contract".

Maintenance of Common Facilities and usage costs are covered by the CERTH Central Administration, the ITI Central Administration, and the Laboratories and Groups, depending on the nature of the expenditure.

ITI is in a healthy and stable financial state. Moreover, its financial stability has been improving over the evaluation period. This constitutes a very strong indication of solid and sound financial management practices.

4. Evaluation of the policies and practices for Inclusion and Diversity, Gender Equality and Scientific Integrity

4.1. Overview

During the site visit, the committee met with representatives from all staff categories: tenured and tenure-track researchers, post-doctoral researchers, research associates, PhD candidates, and administrative and technical staff, following an open call for participation in discussion sessions with the Evaluation Committee.

Staff have unanimously commended the research and work environment of ITI for providing them with invaluable research experience, as well as a challenging and rewarding environment to work that can hardly be found in other industrial or University settings in the broader region or even nationally.

Postdoctoral researchers employed on research contracts have praised the structure and governance of the Institute for offering the opportunity to non-permanent staff to take on the technical lead of projects, while also supporting the unconstrained exploration of original ideas and research directions, and offering access to substantial research infrastructure. Also, the scale and breadth of activities of the Institute have been praised for supporting engagement with diverse technical areas beyond a single project and facilitating the personal development of the researchers.

Research associates and PhD candidates value the scientific diversity offered by ITI due to its size and the diversity of expertise in its various groups that offer opportunities for broader training in areas ranging from visual computing to bioengineering, and from multimedia representation and information extraction to archaeology and chemistry. Also, there was general satisfaction expressed around the doctoral supervision process and a shared feeling that progress monitoring is sufficient and regular.

Professional services (administrative and technical) staff expressed satisfaction for the challenge of the work undertaken, mainly stemming from the scale and diversity of activities the Institute is involved in, and also satisfaction in terms of conditions of employment independent of contracts. The Evaluation Committee have found it commendable how well the Institute's activities are supported by a very small and flexible team of admin and technical personnel – it is indicative that a single systems administrator is responsible for the entire ICT systems infrastructure supporting the breath of activities of ITI, while it is estimated that, even with the addition of 50% additional professional services personnel, they would all absorb a full workload.

4.2. Inclusion and Diversity

At the end of 2021, ITI had 549 employees, seeing a substantial 70% growth from the start of the reporting period in 2018 (322 employees). The majority of the personnel are research associates (65%), followed by Post-doctoral researchers (13%), and PhD and MSc Students (11% combined). Leadership in the Institute is provided by the 19 Permanent Researchers who exhibit a healthy distribution across the different Researcher Grades (4 at Grade A, 5 at Grade 5, 10 at Grade C), demonstrating strong potential for continuity for the years to come. This is also consistent with the age distribution of ITI's personnel that aims to address the experience required for driving the demanding R&D activities the Institute is involved in (30% of the personnel between 36–55 years old) together with the skills required on the latest technological advancements that younger generations bring (70% of the personnel under 35 years old) alongside modern ways of thinking and abilities to work and collaborate in focused research teams.

ITI's organic growth in terms of permanent research personnel has been fairly stable and relatively slow since its inception as one of CERTH's founding Institutes in 2000, by approximately one permanent researcher every two years up to 2019. The tremendous growth of activities has led the Institute's leadership team to take the executive decision to open 10 new permanent researcher positions during the reporting period 2018–21, currently funded by the Institute's own funds. The Evaluation Committee is commending this strategic decision as the only way to sustain and grow the activities of the Institute even further, and also as a substantial act promoting Equality, Diversity and Inclusion (EDI) in the Institute since it demonstrates the Institute's strong commitment to staff

retention and career development. Indeed, staff retention and the financial stability of the Institute were highlighted by various staff representatives across job families and career stages during the Evaluation Committee's site visit as key factors in making ITI one of the most attractive employers in the broader region.

Newly recruited researchers are offered mentorship primarily through the (recruiting) project manager and secondarily by colleagues within the same project or similar working specialty. New recruits start on reduced duties and responsibilities which are subsequently assigned in full according to the pace of familiarisation with the environment. Employee achievements are celebrated both within and outside the working team while additional support is offered when needed. Similarly, all other personnel categories are treated fairly and supported while practices are followed to ensure that the performance of staff (scientific, technical and administrative) is not undermined by the terms of employment, and that employees on a temporary employment contract are not treated less favourably than their colleagues on a permanent contract. The above has been confirmed by members of staff (across job families) who met with the committee during the evaluation site-visit, and who testified to how valued they feel in their role and how much working for the Institute has transformed their own career and personal development. Staff recruited during the Covid-19 pandemic who had to work remotely for a considerable period of time felt valued and that they were entrusted to work more independently while at the same time also felt appropriately supported to progress their work and develop their career.

ITI encourages the creation of spin-off companies with the participation of its researchers and provides initial support by means of use of its Research Infrastructure and space rental in CERTH's incubator under favourable terms and conditions. The Institute distributes the income resulting from generated IP to its inventors of any employment status according to the applicable law and the terms of the employment contract in force.

The Institute has a policy in place for access to its research infrastructure for researchers (both internal and external to the organisation) as well as for other stakeholders including industry and public bodies. The overall management of the research infrastructure incorporates charging models to ensure sustainability through covering maintenance, repair and technical support operational expenditure. The policy also covers research integrity through requiring stakeholders to conform with latest national and EU legislation governing data management (e.g., GDPR), and having obtained operational and ethical approval for their activities. The implementation of individual access policies is carried out in consultation with the administrative office of CERTH and, when third parties are involved, it includes the signing of a Memorandum of Understanding (MoU) detailing the access conditions, the provider's commitments, the users' commitments and obligations (including safety), obligations for data delivery, the Intellectual Property rights, confidentiality, liability, and other legal issues governing the agreement.

The Institute is governed by the 7-member Scientific Council which is composed in accordance with policy set by the CERTH Board of Directors and it includes representatives from the Research and Technical and Administrative personnel of ITI. The Scientific Council meets on a monthly basis and advises the Director of the Institute on strategic and operational matters, including the opening of new Researcher positions, the promotion of Researchers, the selection of new Academic Research Partners, the appointment of deputy Director of ITI, the organisational structure of the ITI, and the Institute's Evaluation.

4.3. Gender Equality

ITI observes CERTH's published gender equality plan⁷ and incorporates the principles of equality of opportunity and fair access for all personnel across all job families. It also observes the guidelines of the European Institute for Gender Equality (EIGE). At the end of 2021, ITI had 549 employees, including 415 men and 134 women (24%). The overall ratio of female staff across all staff categories is stable, observing a slightly upwards trend during the reporting period 2018–21. This is on par with global Science, Technology, Engineering and Mathematics (STEM) workforce gender representation statistics. For example, the latest (March 2022) report of the US National Girls Collaborative Project (NGCP) on the state of girls and women in STEM documents 16% of women professionals in

⁷ <https://www.certh.gr/dat/4F4B18DB/file.pdf>

Engineering and 26% in Computer and Mathematical Sciences⁸. It is within these boundaries where female ratios lie in the 'postdoctoral' and 'research associate' categories, while female representation is considerably higher among staff scientists and technicians (ca 40% on average over the reporting period). Female representation is lower among the permanent researchers, and it is a positive sign that the first female permanent researcher was recruited in 2020. What is particularly encouraging is that female gender representation is considerably higher among participants in the various training programmes (UG/MSc/PhD candidates), where female gender representation is consistently over 30% during the reporting period 2018–21 (with peaks at 50% among MSc/UG candidates and 35% among PhD candidates in 2019). This is considerably higher than global statistics showing 22% women gaining a bachelor's degree in Engineering and 20% in Computer Science⁸.

Even though during the previous 5-year period women have not assumed positions as directors of research labs or departments and have not participated in the ITI research committee, ITI remains committed to balancing these metrics in the next period through taking specific action to:

- Provide women with career advancement pipelines, continuous professional development and leadership training;
- Offer welcoming work environments, including pay equity, flexibility, parental policies and inclusion;
- Develop schemes for mentoring of female researchers;
- Make women more active in decision making through inclusion on boards and processes, thus, changing power dynamics;
- Assist researchers affected by career breaks in regaining research momentum upon return;
- Protect its personnel through anti-discrimination and anti-harassment policies.

In the report, the Institute has outlined specific measures to achieve the above objectives through regular monitoring of gender balance indicators in recruitment, remuneration, capacity building and Continuous Professional Development (CPD), alongside taking positive action towards (among others) training female role models, promoting innovative entrepreneurship within women researchers, increasing women visibility in research communicators events, and offering support against discriminatory behaviours in the workplace.

ITI is committed to following CERTH's established 4-year plan to address any gender equality issues by the end of 2024 across all 6 key areas identified by EIGE (Governance and decision-making; Recruitment, Selection procedures, and Career Progression; Flexible and Agile Working; Gender Strategy in Research; Gender in events and research activities visibility; Gender in Organisation Culture), and has devised a detailed plan of objectives, measures and KPIs to be observed and progress to be reviewed annually. Its topics include balancing the ratio of men to women throughout the Institute, monitoring the employment and merit processes to ensure equal pay for equal work across genders, promoting women for internal career advancement, introducing flexible work models where needed, and establishing a board that will oversee these transformations and enforce changes when and where needed.

4.4. Scientific Integrity

ITI observes the legal framework governing CERTH's Ethics Committee which consists of five members representing, as far as possible, the disciplines and scope of CERTH. The committee meets regularly every month and can also convene under extraordinary circumstances upon request from the Chairman of the Board of the research body. The term for membership on the committee is three years and is renewable only once.

ITI Researchers can request ethics approval for a research activity through submitting to the Ethics committee a questionnaire and a brief report regarding the adequacy and compliance of the research project with the applicable legislation, and the scientific supervisor determines whether the purpose and methodology of the research project conform to the Principles of Ethics and legislation.

The Ethics committee is then responsible for:

⁸https://ngcproject.org/sites/default/files/downloadables/2022-03/ngcp_stateofgirlsandwomeninstem_2022b.pdf

- Examining whether a research project focusing on human and/or animal study is undertaken with the appropriate respect and necessary safeguards concerning the processing of human or animal materials (DNA, cellular material, tissues, etc.)
- Evaluating research projects with respect to generally accepted norms of scientific integrity and good practices.
- Undertaking all necessary measures to ensure that all staff receives regular updates, training and seminars concerning ethics, proper scientific practices and the organization's Code of Conduct.
- Ruling with respect to matters involving Ethics, the Code of Conduct, Conflict Resolution and proper scientific practices as requested by the Board of Directors.

ITI follows CERTH's Code of Conduct & Scientific Integrity which dictates that:

- CERTH's researchers must abstain from any research projects which endanger universally recognized Human Rights or incite racial or social unrest.
- CERTH's researchers should avoid the conduct of research which may potentially cause undue damages and harm to people, society and the ecosystem beyond the established scientific norms and limits.
- CERTH's researchers in charge of research projects should take all necessary measures to ensure the health and safety of the personnel involved within said projects. All necessary measures should be taken to ensure that the personnel involved in hazardous projects is aware of potential dangers as well as the measures in place to contain and avoid them.
- CERTH's administrative personnel must handle and process only the absolutely necessary personal data in accordance with appropriate regulation pertaining to General Data Protection Policies.

Conflict Resolution, cases of scientific or general misconduct, authorship and other disputes as well as harassment and discrimination issues are handled according to CERTH's organisational policy (Internal Rules of Procedure) by the Institute Director in the first instance and by the CERTH Board of Directors based on the severity of each case.

ITI follows CERTH's Personal Data Protection Policy which is governed by the relevant national legislature incorporating the EU's General Data Protection Regulation (EU GDPR), and also CERTH's Internal Rules of Procedure. CERTH has appointed a dedicated Data Protection Officer (DPO) in order to monitor and handle all issues and questions pertaining to the handling of data and data protection in general.

5. Assessment of the National and International Institutional Collaboration potentials

Over its 20-year history, the Institute has founded numerous successful collaborations with academic and research institutes, as well as industry and the public sector, and it has now established a very extensive collaboration network in Greece and across Europe. This is supported and further enhanced by the good inter-laboratory/group collaboration within the Institute and across CERTH too.

These collaborations flourish in the context of ITI's extensive participation in multi-partner national and EU-funded research and innovation projects, but also through bilateral collaborations for the provision of services to private legal entities. Examples of long-term collaborations of ITI include reputable Universities such as the Aristotle University of Thessaloniki, Imperial College London, KU Leuven, University of Madrid; national and European research institutes such as FORTH, NCSR Demokritos, Fraunhofer, the Polish Academy of Sciences; national and European industries and SMEs such as Athens Technology Centre, DRAXIS Environmental, ATOS, Thales, and IBM Ireland; Greek and international public and third sector organisations such as the Municipality of Thessaloniki, the Greek Association of Alzheimer's Disease and Related Disorders, Alto Adriatico Water Authority, and the Office of the United Nations High Commissioner for Human Rights (OHCHR). Overall, the Institute's report includes over 100 indicative collaborations with national and international academic and research institutes, over 120 indicative collaborations with industry and SMEs nationally and internationally, over 40 indicative collaborations with public sector organisations, and over 20 indicative collaborations with the third sector from Greece, Europe, and beyond.

ITI has established partnerships with major Greek and European Universities that allow PhD and MSc students to share their time between their academic institutions and ITI and conduct their research in the context of ITI projects while being co-supervised by senior ITI researchers. Overall, 16 partnerships have been established for the joint delivery of PhD programmes, 2 MSc programme partnerships, and a further 3 strategic partnerships for sustained collaboration in national and EU-funded research projects.

ITI also actively participates in major national, European and international alliances, networks and associations, focusing on ICT domains and applications relevant to the Institute's own research foci. In the Institute report, 18 strategic partnerships are included with various third sector organisations to promote the development of, among others, digital transformation through Artificial Intelligence, Blockchain-based and holistic Cybersecurity and anti-cybercrime technology, e-Health systems, Telecommunications standards and testbeds, "Industry 4.0" and "Logistics 4.0". In addition, further targeted collaboration and strategic partnerships foster synergies to enable ITI to expand its activities in areas such as chemical compounds and the development of new drugs using ICT (with the National Hellenic Research Foundation), AI-empowered technologies on mobile devices (with Samsung UK), and connect its research infrastructure (nZEB Smart Home) to wider smart city and ICT-enabled manufacturing ecosystems (with the Alexander Innovation Zone and DIH VHTP).

ITI's collaborations with national and international partners have resulted in over 160 joint publications during the reporting period 2018–21. In addition, collaborations between ITI and other CERTH Institutes have resulted in 26 publications and 31 projects, while collaborations among ITI's research groups have resulted in almost 100 joint publications and 37 collaborative funded projects between 2018–21.

All evidence above demonstrates that ITI leadership and personnel value collaborations and know how to cultivate synergies to scale and expand the research of the Institute, while also growing individual researchers and groups. This is evident from the remarkable growth of the research activity of the Institute, and also from the 10 new industrial R&D contracts as well as the public/private sector partnerships and Digital Innovation Hub (DIH) initiatives that have emerged during the reporting period and/or are still under development. At the same time, the current strengthening of the broader Thessaloniki area with cutting-edge innovation capability through the launching of leading industrial facilities such as the Pfizer Centre for Digital Innovation (CDI), places ITI in an excellent position to

play a key role at the centre of this 'hub' for research and innovation for the entire region while growing the Institute's collaborations and sphere of influence even further.

6. Evaluation of the Training and Mentoring activities of the Institute

ITI researchers co-supervise and/or advise PhD, MSc and undergraduate students of Greek or European academic institutions who conduct research towards writing their thesis dissertation on topics that fall in the context of ITI's research projects. To do so (a) ITI has established collaborations with universities towards co-supervision but also co-hosting PhD students through MOUs, (b) ITI has established an internship program that allows students to join ITI as interns, (d) ITI participates in Marie Skłodowska-Curie ITN-ETN European Training Networks and Erasmus+ Action programs.

Furthermore, many ITI researchers are visiting professors in leading academic institutions in Greece and Europe, participating in the educational activities of these institutions and transferring knowledge from CERTH towards the students of these institutions in courses and through these supervision.

ITI personnel offered several webinars, tutorials and other training courses during the last four years, aiming to support training of students, researchers, industry representatives, policy makers but also the general public. Moreover, ITI has co-organized hackathons and ITI members has given tutorials, keynotes and talks in well-established and known international and national events. Furthermore, ITI researchers have (co)organized a series of scientific workshops, special sessions and conferences.

Beyond the training and mentoring activities that ITI researchers provide to (external and co-hosted) students at different educational levels, there is significant mentoring efforts that take place within the institute towards training the junior personnel, which comes in a variety of ways. In particular, junior researchers:

- have access to a large pool of senior researchers within and across different laboratories, which can be approached and which act as mentors to junior researchers;
- organize reading groups to read and discuss scientific literature, although recently more and more researchers do this in their own pace at individual level;
- review state-of-the-art work as the first deliverable of each project they participate and discuss this with project partners
- are provided with sufficient chances to enrol to PhD programs. In case they are interested in pursuing a PhD they are assigned a senior researcher as their supervisor, along with an external supervisor and receive training and mentoring by both regarding the PhD research they conduct.
- learn by doing and hence obtain with valuable industrial-like experience.

Furthermore, mid-level researchers:

- receive mentoring from senior researchers regarding time, people, and project management
- have sufficient freedom to explore new ideas and make new propositions to senior personnel

In addition, ITI research personnel have the chance to participate and present their work at conferences and project consortia, attend tutorials and workshops.

In summary, ITI places an emphasis in training and mentoring students and researchers, does that in a plethora of different ways that best fit the needs of the trainees, transferring knowledge from inside the institute to the outside world (in-out) and from senior researchers to junior researcher (top-down) within the institute, and works towards further expanding their educational activities.

7. Evaluation of the innovation and application-related activities and IP protection practices

7.1. Overview

The ITI IP policy follows CERTH's policy for technology transfer and setup of new spin-off companies. The institute does not participate as a shareholder/owner in the new companies; instead, a royalty agreement is developed to reward the institute based on the new spin-off income.

7.2. Innovation and Application-Related Activities

In addition to the numerous high-quality publications, ITI research results in commercialization activities. For the period between 2018 and 2021, the report mentions the following:

- Three patents (the report does not make clear the status of these patents, i.e., whether they are filed or awarded)
- Several online services (that could theoretically be exploited for a fee, even though the report does not hint at any such efforts)
- Six spin-off companies that cover a broad range of disciplines, from health and rehabilitation to robotics, marine science, and computer vision.
- In addition, ITI members participate in the activities of four spin-off companies established before 2018.

This IP policy encourages innovation and motivates researchers to explore the real-world application of their research. However, there are several researchers who participate as principals or members in numerous companies which may challenge their ability to balance their ITI responsibilities and their commercial endeavours.

7.3. IP Protection Practices

This is an excellent policy, flexible and encouraging innovation.

The report does not provide much information about (a) typical royalty levels and the timeline of the agreements, i.e., when does the spinoff start paying royalties, (b) the financial success of the reported spinoffs, and (c) the corresponding royalty income for ITI.

8. Comments/Recommendations on the planned directions and priorities

8.1. Overview

The Evaluation Committee has been impressed by the range and magnitude of activities ITI has engaged with during the reporting period, and also by the resulting achievements: in all primary areas of assessment, ITI appears to be a leading national contributor of research outputs and quality, research income generation and growth, innovation and technology transfer across sectors, when evaluated against global and international standards of quality and magnitude as evidenced and elaborated in earlier sections of this report.

8.2. Recommendations on the Planned Directions and Priorities

The Institute has set an ambitious plan for the future around four main directions:

- To *Innovate*, while pursuing research and innovation excellence building on the high quality of research activities; exploring synergies within and beyond ITI; conducting research in an Ethical and Responsible manner; and adapting to the changing funding landscape.
- To *Grow*, diversifying funding and sustaining the long-term development of the Institute; extending and maturing the technologies and services developed and growing innovation through the creation of spin-off companies; attracting and sustaining highly-skilled researchers through providing a supportive environment that rewards excellence.
- To *Improve*, through the continuous monitoring of progress; the growth of strategic partnerships with other national and international institutions; and the improvement of laboratory facilities and equipment.
- To deliver *Impact* to industry and the national and European economy and society, promoting and advancing citizen's well-being, and aligning the research priorities to national and local societal and financial needs.

The Evaluation Committee is commending this ambitious and goal-driven plan, and trusts that the Institute's approach to deliver on this plan is necessary and needs to be supported in order to enable ITI to pave the path to a glorious future. The Institute has seen unprecedented growth in activities, success, and size during this most recent reporting period, and now is the right time for this momentum to be supported unreservedly in order for ITI to establish itself as a major employer in the north of Greece, and an island of excellence that will make leading contributions to Greece's standing in the international research scene, and also support the development of Thessaloniki's regional industry through its innovation, IP generation, and knowledge (and talent) exchange.

8.2.1. Recommendations for the Institute

Reinstate regular seminars at Institute level: The Evaluation Committee understands that ITI used to host seminars from prominent researchers regularly in its premises. This activity seems to have somewhat worn off over the past few years, also due to the pandemic. The Evaluation Committee recommends that Institute-wide seminars delivered by prominent scientists based in Greece and abroad are reinstated on a regular basis and appropriate frequency. This recommendation is in line with the Institute's desire to increase its regional and national outreach, and to invigorate research culture at a time when the Institute's personnel and areas of research activity are expanding, and to attract high-quality personnel (from Greece and from abroad) by making the Institute's activities well-known to high-profile researchers.

Establish regular internal seminar series in the research groups/labs: In order to promote inclusivity and support for the development of researchers (esp. early-career), the Evaluation Committee would like to encourage individual groups/labs to establish a regular (e.g., biweekly) seminar series that will be delivered and organised by members of the Group/Lab. This will give the training opportunity to members of the Group/Lab to present the work and get feedback from an early stage, practice their presentation skills, consider their own work in the wider research context, and also facilitate more interaction and increase collaboration within and across groups.

Promote visibility of diverse role models: In line with the Institute's measures and interventions for promoting Equality, Diversity and Inclusion, the Evaluation Committee would encourage the promotion of diverse roles models, especially for female students and early-career research staff. This can include a number of activities, from organising regular meetups with talks from leaders in the field, to expert workshops and social events to provide a friendly environment for women or other underrepresented groups to interact in a research, professional, or social setting.

Increase regional and national outreach to grow the Institute's visibility: The Institute regularly organises and/or participates in dissemination and outreach activities targeted at the general public, while the work of individual research Units and groups is (re)presented in diverse fora and exhibitions as well as in the press. The Evaluation Committee recommends that the ITI Open Day is reinstated following the Covid-19 pandemic as a regular event and to consider organising it annually. Also, to take advantage of the three ITI subsidiaries in Volos, Athens, and Ioannina, and organise local outreach events where research from the entire Institute will be showcased. The committee recommends that some resource and effort is directed at promoting such events using appropriate corporate communications strategies (e.g., social media campaigns, direct marketing promotion, etc.) to relevant industry and Universities in the different subsidiary regions in Greece. This way, the recent growth and also research and impact achievements will be showcased more broadly, while ITI's excellent research and commercialisation opportunities will be promoted to the relevant target audiences (potential industrial partners and future employees/students) across the country.

8.2.2. Recommendations for the Greek State

In addition to the above recommendations that are directed towards ITI itself, the Evaluation Committee also wish to extend recommendations to the Greek state, through ITI's supervising authority, the GSRI:

Fully endorse ITI's plan for personnel growth: ITI entered the reporting period (2018) with 2.8% tenured and tenure-track researchers among all ITI staff (9/322) which is unacceptably low by any international standard. During the reporting period and in order to support the tremendous growth in successful activities that resulted in 70% growth (to 549) in its personnel, ITI's Leadership took the brave decision to increase the number of its tenured and tenure-track research personnel to 19, supporting the additional tenure-track staff recruited using own funds. This only slightly increases the overall percentage of tenured and tenure-track researchers to 3.4%. The Evaluation Committee recommends that this expansion is endorsed by the Greek State and the recently appointed tenure-track researchers are eventually promoted on to permanent contracts funded by the State's regular budget contribution.

The Institute proposes the addition of **10 permanent researcher positions** to support areas of existing competence and increased activity, and also to strengthen complementarity and synergies between areas – for example, the identified potential for synergies between Communication & Networking and AI-related research. Also, the addition of **8 new positions for collaborative scientists** to support ITI Labs and Units. And **5 new positions for administrative personnel** to support and sustain the Institute's growth. Indeed, it seems remarkable how the current 26 (end of 2021) staff scientists and technicians and administrative personnel are able to support such magnitude of activities: 428 projects attracting a total funding of €76.4M. The Evaluation Committee recommends that this ambition should be fully supported by the Greek State so that ITI can sustain this impressive multiplier on return on investment of attracting funding of €41 from competitive grants for every €1 of regular budget received by the State.

Reinstatement of Matching Funds: Matching Funds allocated to the Institute to cover operational expenditure outside the regular budget seem to have reduced to 0.00 in 2021. The Evaluation Committee recommends that such funding is reinstated on top of the regular budget.

Support for Infrastructure Investment and Expansion: The Evaluation Committee fully endorses the plans of the Institute to expand its research infrastructure as this has been detailed in the Institute's report. It is indicative of the current lack of adequate space to accommodate the magnitude of current research activity that, one of the largest and successful Groups of ITI (VARLab) with over 300 personnel, occupies only a single modest lab space able to accommodate no more than a handful of researchers at any given time. To this end, the EKETA 2.0 project with the support of

around €10M from the EBI (European Investment Bank) and National funding should be a decisive solution in providing an adequate environment to host ITI's research activity.

Modernise national legislation to reduce bureaucracy: The Evaluation Committee recommends that the State revisits national legislation to support the flexible and timely operation of the national research Institutes, also with a view towards removing any impediments to their growth.

Support access to business-level Cloud services (e.g., Office365): The Evaluation Committee recommends that business-level subscription to Cloud services for the hosting of data, email, and facilitating collaboration should be supported by the Matching Funds the Institute receives from the State as this represents a regular need of the Institute to modernise working practices, support existing needs for collaboration, and increase efficiency in the long term through reducing operational expenditure by not having to maintain an in-house non-research ICT infrastructure.

Support infrastructure for Open Access of research outputs: The Evaluation Committee recommends that additional funding is provided in support of establishing a permanent institutional repository infrastructure (and support personnel) for the depositing of publications compliant with the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH), to support different Open Access types and to facilitate discovery and sharing of ITI's work with the research community and the wider public who often are the primary funder of research through taxation.

8.2.3. Reflections

A common strategy for the longevity and prosperity of Units (e.g., Departments or Research Institutes) in Research and Higher Education Institutions worldwide is to grow organically through increasing the number and diversity of their (academic/research) staff to then be able to achieve economies of scale and build critical mass that will allow them to tackle larger problems and establish their reputation. ITI has markedly achieved the inverse: to succeed enormously in achieving excellence while significantly scaling and diversifying their activities, building on its existing excellently trained talent and the excellent management of its human capital. Also, while sustaining an inclusive and supportive environment its employees are passionate about and motivated to work for.

It is now time for the State to generously support ITI's success story, and invest on the high returns the Institute has been bringing to the region and to the nation.

9. Summary enumerating the Institute's Strengths, Weaknesses, Opportunities and Threats (SWOT analysis)

9.1. Strengths

- Conducting high quality research in key technology areas
- Employment of high-level research and support staff
- Enjoying international reputation and recognition
- ITI is extremely successful in attracting external funding through competitive R&I research
- A very extensive academia and industry collaboration network in Greece and Europe
- Good inter-laboratory/group collaboration
- Offering a very good working environment
- ITI owns and continuously further enhances advanced research infrastructure
- Inspired and competent leadership for a number of years
- Strong links to higher education institutions in Greece and ongoing development of such links with institutions abroad

9.2. Weaknesses

- Insufficient space to host all of ITI's activities in one place
- National reputation and recognition lag behind its international achievements
- Bureaucratic, inflexible, and time-consuming governance and management, accordant to the legal provisions for public institutions
- Limited research-oriented industry in Greece in the areas of interest to ITI
- Insufficient numbers of qualified research staff in Greece and in the region
- Insufficient differentiation between the various labs, potentially leading to coordination inefficiencies

9.3. Opportunities

- The EKETA 2.0 project, which can be exploited to finance the construction of two new buildings to be used by ITI
- Adoption of new development plans in line with the Smart Specialization initiative, and European framework programs such as Horizon Europe, Digital Europe, and EDF.
- Extend existing and develop new activities in emerging technologies, e.g., Energy Analytics, Health Analytics, Cybersecurity, Internet of Things, Trustworthy AI, etc.
- Build upon recently concluded research contracts with multinational industry
- Expand innovation transfer and spin-off activities
- Further explore funding opportunities from the private sector

9.4. Threats

- Existence of strong competitors in the region
- The continuing "brain drain" of experienced highly qualified research personnel
- Slow adoption of innovative & emerging technologies in Greece
- Decrease and diversification of goals of European funding sources
- Lack of long-term stability of the national R&I landscape

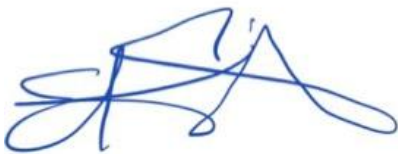
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