**European
Engineering Learning Innovation
& Science Alliance**

MISSION STATEMENT

We, the undersigned alliance partners, Budapesti Műszaki és Gazdaságtudományi Egyetem (BME, Hungary), Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU, Germany), İstanbul Teknik Üniversitesi (ITU, Turkey), Scuola Normale Superiore (SNS, Italy), Scuola Superiore Sant'Anna (SSSA, Italy), Universidad Politécnica de Madrid (UPM, Spain), Universitatea Politehnica din București (UPB, Romania) and three French graduate engineering schools -École des Ponts ParisTech, Mines ParisTech and Chimie ParisTech (both affiliated to Université PSL)-, together with our associate partner ENAEE (European Network for Accreditation of Engineering Education), are joining forces to build a European University alliance under the name "**European Engineering Learning Innovation and Science Alliance (EELISA)**".

Our higher education institutions represent more than 180,000 students and 50,000 graduates each year, 16,000 faculty members and 11,000 administrative staff. Following the motto "**United in diversity**", EELISA brings together complementary strengths and profiles across Europe with respect to:

- Engineering education:
  EELISA covers three technical universities (ITU, UPB, UPM), one technical university with a management focus (BME), three *Grandes Écoles* specialising in engineering (Chimie ParisTech, École des Ponts ParisTech, MINES ParisTech), two full-spectrum universities with a focus on engineering and innovation (FAU and PSL) and two comprehensive higher education institutions (SNS, SSSA). We are all well known as excellent education and research institutions in our countries, although we differ in size (from 2,000 to 40,000 students) and history (ranging from the first engineering institutions in Europe founded in the 18th century to 30-year-old schools), and we can therefore build a replicable model. We all value the integration of research in our curricula, are specifically renowned for our basic, but also innovation- and application-oriented research and have developed strong links with our regional and national economies.

- Political background:
  EELISA covers three European regions, ranging from founding members of the European Union (France, Germany, Italy) and countries that joined in the third (Spain), fifth (Hungary) and sixth enlargement (Romania), as well as an accession candidate (Turkey). Large countries with traditionally strong labour markets are united with countries that have managed and are still managing structural transformations. All of us are rooted in metropolitan areas of Europe, including five capital cities. All our regions serve as centres of economic activity and attraction and technology hubs for our respective countries, with a growing population and a highly dynamic economic environment able to absorb the momentum of scientific innovation.

Understanding the need to add value to engineering with the general-purpose skills offered by our consortium members, we believe that this unison in diversity is a very appropriate lever to transform engineering higher education in Europe, and to build new bridges between the applied sciences and education in order to train a new generation of engineers who will be engaged citizens able to face the challenges of tomorrow.

We already collaborate at different levels thanks to bottom-up initiatives like Erasmus agreements, joint degrees, research collaborations and the ATHENS network (Advanced Technology Higher Education Network/SOCRATES). We regard the European Universities call as a perfect opportunity to reformulate this collaboration and take it to a completely new level, innovating through new joint activities and addressing higher ambitions in order to substantially enhance the quality and performance of engineering education in Europe. With innovation in research and education as our shared vision, we aim to give our students the opportunity to earn a European degree in engineering and increase their competencies and employability so that they can work anywhere in Europe in either the world of academic research, the private sector or public administration.

As a network of renowned technological universities and full-spectrum universities and schools, we will cover the whole scope of skills needed to train engineers for the future. ENAEE (European Network for Accreditation of Engineering Education), responsible for the development of the framework of EUR-ACE® standards and label, will be our main professional partner to build the European engineer's degree and overcome the frontiers of engineering education in Europe; we have also built links with our national accreditation agencies. Moreover, a fundamental aim of EELISA is to take on board the engineering education needs of external stakeholders, include joint research and transfer activities so that their outcomes serve society and humanity, and help build smart and sustainable solutions for Europe.

OUR MOTIVATION

EELISA is driven by a common understanding of, and a motivation to overcome, major societal challenges. As European higher education institutions in a rapidly changing world, we are all facing the fact that engineering –especially in Europe– is not currently developing its full potential. This is evident from the following observations:

Founded in ancient times with some landmarks that have lasted until our present times, **modern engineering** was born as an energetic sibling of Enlightenment and was, for three centuries, the best synonym for innovation. Engineering applies scientific progress to private and public needs and has been a cornerstone for the consolidation of our social contract. However, today, while technology opportunities and problems evolve faster than ever, STEM (science, technology, engineering, mathematics) vocations are in severe recession.

Europe is proud of its culture and aware of the need of a **humanistic approach** toward sciences. Moreover**, European countries** are among the most dynamic economies in the world with the most consolidated democracies and welfare states. Engineering careers, on the other hand, are confronted with hurdles inside and outside the national borders of our continent. Thus, **engineering in Europe appears to be a fractal image of both the successes and the constraints** that we face in Europe:

- The long tradition of engineering in each European country has crystallised in heterogeneous regulations, even though ENAEE standards have been adopted by 3,000 engineering degrees and even by some universities outside of Europe. Still, a lot of countries have adopted Anglo-Saxon references in both contracts and training (Washington and Sydney Accords). This also results in mobility and recognition barriers within the continent.

- The competitiveness of Europe is strongly dependent on technological developments, which requires strengthened knowledge transfer efforts.

- Innovation is deployed in more dimensions than science and technology, just like economics, arts and further human sciences, which are important drivers of value creation that are currently not being seized upon enough in Europe. Moreover, active and future engineers are seeking opportunities to strengthen their competencies through lifelong education in hard and soft skills.

- The lack of skilled labour in engineering is slowing down economic growth, and campaigns have been launched over again in Europe specially to attract more women to STEM careers.

Besides the challenges to the profession, **academic engineering is also undergoing a fundamental transformation**. The Bologna process, which enables higher education institutions to evolve within a common Bachelor-Master-Doctorate framework, is still under construction, as it does not include other nationally accredited curricula. In this context, there continues to be **lack of integration that hinders both the mobility of students and the mobility of skills at the professional level.** Engineering in Europe is strongly defined by the characteristics of undergraduate education in each country, which all share a curriculum that combines a sound scientific foundation applicable in different technological sectors.

Graduate schools of engineering and universities in Europe have intensively participated in student mobility but professional practice remains largely intra-national due to

professional regulation. An engineering student quite often gets the chance to take part of the curriculum abroad, but may, upon graduation, find it difficult to get this experience recognized for professional practice in other European countries because the accreditation systems in each country are different (despite programme contents and learning outcomes being similar).

Albeit globally recognised for its excellent standards in education and practice, **European engineering struggles with innovative creation processes and transfer to the market and to society**:

- Boundaries between formal and informal learning are getting thinner. Individuals are more aware that they have to acquire and further develop competencies all their life inside and outside of educational institutions. However, universities often have difficulties in connecting these spheres.

- Although the core objectives of higher education institutions –designing, implementing and certifying teaching processes and learning outcomes– have never been more valid than in today's highly competitive international environment, the means to pursue these objectives have to evolve. However, only at certain stages of their educational process are students involved in research and innovation, and generally merely as supporting actors, whereas the knowledge economy requires more and more ideation and creation. As for teachers and researchers, they are increasingly active in innovation transfer and dissemination, but rarely engaged as the leaders of public debate about societal challenges.

- There is a greater need for interdisciplinarity and communal action to develop specific knowledge: it is no longer possible to tackle all challenges alone without drawing on multiple expertise. Not only do engineers need knowledge from social sciences, other professional communities need to build stronger bridges with engineering.

- The importance of transferable, so-called soft skills is traditionally underestimated in engineering education; however, such skills are of high importance in problem solving, knowledge transfer and thus in an engineering career.

- Climate crisis is now the major threat to our global community. Even climate activists demand a more prominent role for scientific knowledge, and the younger generation of students regard sustainability as a driving topic. Nevertheless, engineering sector is not as visible and engaged as it could be.

Consequently, universities should understand that their role within a society of "learners" is not to conserve an oligopoly of contents-intermediaries, but to guarantee valid scientific knowledge, to engage in transferring and rounding out this knowledge with practical skills and to become a "curator" of a useful learning path for each person protecting the wealth of diversity. We are convinced that the **incorporation of societal challenges into engineering education** can help our institutions to assume this new role and illustrate our responsibility.

OUR VISION

> **EUROPEAN ENGINEERING EDUCATION FOR A SMART AND SUSTAINABLE SOCIETY (E^3S^3)**
>   -   Vision of EELISA

We envision a future in which society thrives and masters global challenges with smart and sustainable solutions empowered by European engineering. The fundaments for this future must be laid in higher education. Thus, we want to transform European engineering education in a way that we open learning up and combine innovative teaching methods across our institutions to convey basic knowledge more efficiently. This will be significantly rounded out with interdisciplinary learning, the development of transferable skills and real-world problem solving together with extra-university partners. In summary, this will not only equip our graduates with future-oriented competencies and raise their employability, it will also create more sound knowledge partnerships with industry and society in order to further align smart technology with sustainable needs. In this way, EELISA will contribute to the achievement of the European Green Deal and to an inclusive transformation of "the EU into a fair and prosperous society, with a modern resource-efficient and competitive economy" (EC COM (2019) 640 final).

OUR STRATEGIC PRIORITIES

EELISA's mission is ultimately to transform the whole European Higher Education Area, converting it into a central actor and a model in Europe for solving societal challenges and empowering student citizenship participation and employability by:

- Re-inventing the "European engineer"
- Democratizing engineering education
- Evolving interdisciplinary engineering learning
- Fostering knowledge and technology transfer
- Stimulating inclusiveness
- Inspiring others

EELISA will define and implement the common model of a "European engineer" rooted in society as a lever for European citizenship

Our ambition is to become the first alliance of leading higher education institutions from different countries in Europe to define and implement a common model of a "European engineer" rooted in society. This approach will be reinforced by addressing European citizenship, social consciousness, soft skills and entrepreneurship education. We want to go beyond the implementation of using EUR-ACE® or country-specific labels as mere endorsements of our programmes to incorporate this accreditation in a shared strategy, focusing on innovation, employability and inclusiveness.

This model will be developed with the special involvement of ENAEE, together with stakeholders in the engineering profession, and it has four dimensions: (a) a common set of learning outcomes, (b) a certain harmonization of educational organisation and practices, (c) the convergence of professional regulations within Europe (d) an internal quality assurance system. Indeed, ENAEE brings together national accreditation agencies for engineering degrees and will support the consortium in designing a simplified single accreditation process at European level.

For now, there is a European ambition to move the European Research Area and the European Higher Education Area (EHEA) closer together and strengthen the links between innovation, research and education, especially within HEIs. As a demonstrator, EELISA will contribute to the consolidation of the European Higher Education Area and, more generally, to the progress of European Union values as a whole. EELISA will hence strengthen the international competitiveness of higher education in Europe.

EELISA will democratize engineering by disseminating an engineering mind-set

EELISA aims at extending the high art of engineering based on a deep technical knowledge and the understanding of contexts by disseminating an engineering mind-set. We will thus enhance the Europeanization of curricula and the intercultural skills of students, faculty and administrative staff members, facilitate mobility and exchange and implement innovative teaching and learning formats.

We will internationalise engineering curricula and enable accessible and stepwise recognition of student achievements, ranging from credentials for engagement in academic communities, through diploma supplements, to a common European engineering degree.

We will promote the European engineering model across institutions of varying sizes, with different focuses and traditions. We will create an apprenticeship track to attract students from different backgrounds and increase the diversity of student profiles. This track will combine paid work and part-time academic courses throughout the entire curriculum. Apprenticeship will also contribute to innovative education insofar as it introduces specificities, placing the student at the centre of new educational models, with an advanced skills-based engineering teaching approach, a new type of learning outcome assessment, a new training stakeholder: the apprenticeship tutor.

EELISA will offer a new interdisciplinary learning experience that combines teaching, research and transfer, oriented towards Sustainable Development Goals

EELISA will incentivise a paradigm shift in engineering education so that students, as well as teachers and researchers, have to widen their perspectives in order to produce sustainable scientific solutions. Accordingly, as of their first day in our universities and schools, our students will not only work to meet their respective diploma requirements, but will be active participants in tackling real-world challenges. EELISA students will, in fact, have the chance to get in touch with the academic research community through curricular apprenticeships. We will guarantee valid scientific knowledge, which our students will be able to transfer to companies, administrations and to society as a whole. We will also put students into contact and help them understand problem-owners and other stakeholders in order to identify and tackle socio-technological challenges. Therefore, we decided to target Sustainable Development Goals (SDGs) in view of their ambition, their supporting institutions and their clear structure.

We will systematically integrate different disciplines, soft skills, research activities, entrepreneurship and technology transfer into engineering education, starting from undergraduate level. Through this integration, we intend to show that engineering schools and technical universities are not merely institutions specialising in certain fields, but also integrators, building bridges between science and society. We will also work on extending engineering abilities to other disciplines. With the traineeship programmes, we intend to promote European Union as a cardinal point for academic research training.

EELISA will foster knowledge and technology transfer and create industrial research cooperation models

EELISA's mission is to contribute to promoting research and development activities and programmes and to creating a sound basis to utilize the intellectual products created in higher education and research. EELISA intends to be leader in knowledge transfer toward the society and to the industry.

The aim of improving the methodology of technology and knowledge transfer is to assess, register and evaluate the available knowledge basis, intellectual results and products, to raise the prestige of university researcher positions, to improve the competitiveness of education, to increase strategic partnership capacities in industrial research and development and to protect and utilize intellectual products. As a result, innovation performance is expected to increase, and new achievements will be used in practice with better efficiency, resulting in benefits to society and industry, and thus increasing Europe's competitiveness as well.

EELISA will stimulate inclusiveness in the engineering profession

Together with excellence and effectiveness, EELISA is committed to the policy principle of inclusiveness so as to enhance social equity and social mobility. EELISA will support students from a modest social background through part-time study. Gender will also be a special focus in a profession with only 30% of women across Europe (fewer in top positions). We are convinced that, without gender equality in STEM, it will be impossible to get students to focus on changing the world as an equally ranking mission as earning their diplomas.

Moreover, EELISA is a tribute to female engineers through one of their pioneers, Elisa Leonida Zamfirescu, who had an important career in geological engineering and a cross-border European biography (Romanian, granddaughter of a French engineer, graduated in Germany, served in a hospital during the First World War and later engaged in disarmament).

Besides gender, we will pay attention especially to minorities and to refugees, which is both a social urgency and an opportunity for European economic and demographic consolidation. Our universities are rooted in society, and we aim at inspiring future students from any background to become engineers. Our partnerships with local authorities will be key in this respect, as will cooperation with university networks aimed at the international protection of scholars and students or UN agencies.

Finally, students will be involved in EELISA governance, through the governing board and the academic and scientific board. They will contribute as European citizens to the development of EELISA, as well to governance and the EELISA communities.

EELISA envisages a university image that will inspire others

Our alliance intends to foster the attractiveness and performance of EELISA so that we can give more opportunities to our students and alumni to build a better Europe in both the economic and social dimensions. The diversity in our geographical basis, organization, size and even resources ensures that our cooperation would define an inclusive model that can inspire others. Our alliance will experiment and assess cooperation in all dimensions, with innovative instruments such as the joint appointment of EELISA professors.

EELISA will not only be a reliable knowledge provider but also a committed actor and leader of the social transformation. We will act as intermediaries to enable inter-disciplinary efforts and multi-actor collaboration, allying knowledge and commitment. By opening new ways of communication for academic institutions and sharing contents, projects and solutions, we intend to be a role model for open science, open education and citizen science.

The prototype of our ambition will be "European engineering", which is consistent with our main area of activity. We regard this as a good proof-of-concept for the whole education sector and plan to build this prototype based on two pilot tracks, directly related to Sustainable Development Goals: 1) Smart, Green and Resilient Cities and 2) Sustainable and Smart Industry. These areas are also deeply aligned with two of the Horizon Europe Research Areas (climate-neutral and smart cities; adaptation to climate change) and, in the immediate years, we will be able, thanks to our capacities, to follow up the other priorities of this agenda (healthy oceans, seas coastal and inland waters; soil health and food; cancer).

OUR MISSION BOOSTERS

Our mission implementation will be accelerated by our three strategic mission boosters: (1) communities, (2) diplomas and credentials, and (3) campuses.

Socio-technological challenges to be tackled by EELISA communities as a key to innovative creation processes

The EELISA communities are the place where education, research, innovation and public debate coexist and connect, enhancing the connection of engineering with society. They are challenge-oriented multidisciplinary teams, including actors from different academic backgrounds, academic and practical expertise from our institutions (students, faculty, administrative staff) and real-life problem owners (city councils, other administrations, companies, NGOs). The entry to communities will be open to any actor of the EELISA network ready to share knowledge and ideation. Communities will enable the mixing of age groups, hierarchies and perspectives and successively grow, e.g. via the engagement of EELISA alumni that become professionals or employers. EELISA communities will thus not be restricted to academic names, but have a solution-centred perspective. This makes them responsive to external changes and trends and attractive for prospective students, researchers and new academic and societal partners. In the long run, the EELISA Communities will offer a broad coverage of the most relevant socio-technological challenges and will thus contribute to making the alliance's universities leading institutions in transdisciplinary problem solving, thus reinforcing European citizenship and public debate. An EELISA community will be a stable structure but will periodically adapt its priorities and even name in order to adapt to new members' capacities and interests and to opportunities to address new challenges.

Challenges are understood as calls for real-world engineering solutions, with a social, economic or ecological component. They will refer to a central paradigm of the global community, such as the Sustainable Development Goals. Each challenge will be set by an extra-university institution (e.g. industry, associations, public institutions, regions or municipalities, NGOs, applied research, business incubators), answered/elaborated by student groups and supervised by academic staff across the EELISA institutions.

A modern system of achievement recognition via credentials, an EELISA diploma supplement and a European framework for degrees in engineering

We advocate that education should be considered as a portfolio of accomplishments that goes beyond earning diplomas. Accordingly, EELISA will introduce a new form of recognizing student qualifications, which will be achieved by a three-step model, ranging from the EELISA credential, through the EELISA diploma supplement standard, up to the EELISA degree awarded with the EUR-ACE® label.

Our ambition is that students will not come to university just to "learn" (for which they will be awarded a "diploma") but also to solve global problems and design the sustainable technologies of the future. They will also transfer their own competencies to other students when going to another EELISA campus and enrich the communities with intercultural dimension. The "credential" will certify their commitment and proven ability to understand and even identify social challenges, be an active part in establishing the relevant stakeholder alliances and contribute to providing sustainable solutions.

The **EELISA credential** will be introduced from the first day of its implementation at bachelor and master level. It will be based on competencies and recognize student achievements besides the basic engineering modules in the form of (micro-)certificates (e.g. badges for mastered projects, internships, etc.) and in the form of collective evaluation (e.g. teamwork, tutor- and peer-assessment, coaching). It will be made available for any student in our organisations participating in one of the EELISA courses and/or events, even outside of the engineering curriculum.

The **EELISA diploma supplement** will contribute to developing the European commitment of the students. To earn this diploma supplement, physical mobility abroad will be compulsory during a yet to be defined period. Students will take courses recognized by the EELISA alliance in a joint catalogue for at least 30 ECTS. They will be involved in an EELISA community that will raise their awareness as European citizens of the challenges we have to tackle. They will learn foreign languages and work in international teams so that they can develop their intercultural skills.

EELISA will develop, **a rigorous «EELISA European engineering» model** that could be appraised by any employer worldwide. This model will give students the opportunity to choose from a spectrum of intensity, ranging from an engineer programme with a European touch to a fully Europeanized curriculum. These multisite **EELISA degrees** will begin in two pilot tracks: "Smart, Green and Resilient Cities and "Sustainable and Smart Industries" that will later be extended to other areas. It will rely on a common internal quality assurance mechanism for managing EELISA activities and assessing both the quality of teaching and student learning outcomes. This mechanism and the quality requirements will set the mark for demonstrating what a European engineer is.

⟨ An EELISA campus for everyone

To facilitate student and staff mobility between all campuses, we will build an EELISA campus for everyone:

- By working together, we will demonstrate that all students can feel at home in each campus and in the virtual EELISA campus during their studies whatever their mobility patterns, their origin, etc. We will set a specific programme to share scientific infrastructures in order to improve and widen our research and its impact on our students' training.

- Professional services will thus work closer and closer to make our campuses an EELISA campus. Via exchanges of best practices and the setup of common activities linked to student support, students within EELISA will face similar situations and get appropriate support as if they were at home. Our processes will be aligned first via the EELISA Charter for an automatic mutual recognition of higher education qualifications and learning outcomes abroad. In the long term, we aim at having compatible systems benefitting from ongoing initiatives, such as Erasmus without paper.

EELISA will develop **joint activities** (e.g. summer schools) **and EELISA communities** so that students and staff will be connected with each other, even if they are not located at the same campus. By working together virtually, they will contribute to **building the EELISA virtual campus beyond the national borders** and creating an EELISA spirit among all community members.

Students and staff will be involved as actors of the living labs, as well as partners of the communities and citizens of their cities. Students will be involved in EELISA governance, the governing board and the academic and scientific board. They will contribute as European citizens to the development of EELISA, as well to its governance and the EELISA communities. The EELISA campus will stay open for alumni, as we believe that alma mater have a particular role in orienting and supporting their former students in **life-long learning**.

Indeed**, campuses** will also be a key element in the pedagogical development of degrees, EELISA communities and citizen science. They will be used **as living labs and/or test beds for sustainable innovations** linked to the curriculum. While retaining their specificities (e.g. geographical and cultural terms), the EELISA campuses, scaled up as models for cities and for the planet, will illustrate our capacity to build a European alliance "**united in diversity**".

Thus, as Presidents, Rectors and Directors, we commit our higher education institutions to join our strengths to reinforce Europe through the creation of our European Engineering Learning Innovation Science Alliance (EELISA).

Europe, February 2020

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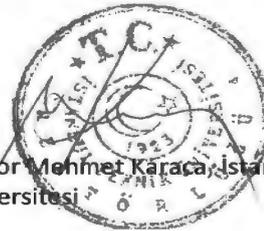
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