

European Engineering Learning Innovation & Science Alliance



Mission Statement

We, Rectors and Directors, on behalf of the European Higher Education Institutions we represent, gather in Madrid on the 29th January 2019 so as to launch the European Engineering Learning Innovation & Science Alliance, engaging us as follows:

Our mission

As European sciences & technology universities and engineering schools, we aim to contribute to move from “engineering in Europe” to a genuine “European engineering” linked to interdisciplinary and sustainability.

EELISA will contribute to solve societal challenges empowering our students’ citizenship participation and employability raising.

EELISA will be a consolidator for European Union values progress in general and a major demonstrator for higher education institutions in all sectors within the European Higher Education Area and beyond. EELISA will contribute to strengthen the international competitiveness of higher education in Europe.

Our vision for engineering and Europe

Engineering appears to be a fractal image of both the successes and the constraints that we face in Europe. While we are globally recognised for our excellent standards in education and practice, we also deal with relevant mobility and recognition barriers within the continent.

Founded in ancient times with some landmarks that have lasted till our present times, modern engineering was born as a vigorous sibling of Enlightenment, and for three centuries was the best synonym for innovation. Engineering applies scientific progress to real private and public needs and has been a cornerstone for the consolidation of our social contract. But today, while technology opportunities and problems evaluate faster than ever, STEM (Science, Technology, Engineering, Mathematics) vocations suffer an important crisis. How can this paradox be explained? And how is it related with Europe integration? How interdisciplinarity can contribute to address and reinvent engineering?

European countries are among the most dynamic economies in the world and by far the most developed democracies and welfare states. But engineering careers in our continent are confronted to hurdles inside and outside our borders:

- Our relatively high living and work standards make easier for everybody to freely choose an occupation, but this also means that the academic investment for becoming an engineer is less profitable than in more utilitarian societies;
- This is especially critical for gender balance: engineering vocations have started to decrease in Europe before women had equal opportunities to access those careers when they had more social and wage compensation;
- The long tradition of engineering in each European country has crystallised in heterogeneous regulations, while the rest of the world has adopted Anglo-Saxon references both contracts and training (the so-called Washington and Sydney Agreements);
- Advanced engineering is threatened by counterfeit in countries where the rule of law is less consolidated;
- Innovation is deployed in more dimensions than science and technology, in other words, design and marketing are important drivers of value creation, but European share regression in manufacturing places our companies further away from consumers and weakens most of our States and the Union due to commercial imbalance.

Where are we today

Engineering in Europe is strongly defined by the characteristics of initial education in each country. They all have in common a curriculum that combines a sound scientific base with application in different technological sectors. An identification of engineering degree to master level was also an historical element of continental engineering although there has been a constructive effort to adapt to Bologna process and enable bachelor as a sufficient access to industry.

Graduate schools of engineering and universities of science and technology in Europe have intensively participated in student mobility but professional practice remains largely intra-national due to professional regulation. Quite often an engineer student gets the chance to follow a part of its curriculum abroad but, when graduated, it is often quite difficult to be recognised for professional practice in many other European countries which only enable automatic recognition for their national diplomas even if the structure and content is quite similar across countries (although pedagogy and governance may differ a lot).

Aware of this situation, engineering higher education institutions and professional bodies meet in several forums where they share best practices and try to unify guidelines and regulations. The most spread and effective network is ENAEE (European Network for Accreditation of Engineering Education) whose standards have been adopted by 3,000 engineering degrees, and even adopted by some universities out of Europe. It defines how an engineer should be trained (workload and other specifications) but also what for (outcomes), building the bridge from education to social and industrial needs.

Even ENAEE's success is limited: although it has an impact on in already one third of engineering degrees, the professional regulation ceiling for mobility remains mostly unchanged and the issue never makes its way to first-page political agenda, apart from general recommendations for market liberalization.

The 9 higher education institutions (graduate engineering schools, technology and comprehensive universities) that have founded the EELISA consortium, with ENAEE as associate member, share the same concern and engagement about the necessity to build a "European engineer" identity. It will foster our attractiveness and performance so that we can give more opportunities to our students and graduates to build a better Europe, both in the economic and social dimensions. The diversity in our geographical basis,

organization, size and even resources level ensures that our cooperation would define a challenging model than can inspire others. Our incipient but successful cooperation in some exchange and best-practice network give us confidence that we will be able to meet the ambitious expectations set for European universities: interdisciplinarity, innovation, mobility, inclusiveness, sustainability and employability.

Why EELISA?

Our ambition is to become the first alliance of graduate engineering schools, technological universities and a comprehensive university from different countries in Europe that define and implement a common model of “European engineer” rooted in society. We want to go beyond the implementation of using EUR-ACE or other labels as mere endorsements for our programmes to incorporate this accreditation in a shared strategy, focusing on employability and inclusiveness, particularly via apprenticeship.

EELISA stands for ‘European Engineering Learning Innovation and Science Alliance’ which refers to the four missions of our institutions: teaching, research, innovation and dissemination. It also reflects the relevance of gender balance as a prominent cause for the entire Europe, but also specifically in STEM careers. It pays tribute to women engineers, through the memory of Elisa Leonida Zamfirescu, one of the very first that obtained a degree in our field and had 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). The project acts for a greater equity for its students and within its partners institutions.

The consortium

The EELISA Alliance is comprised of technology universities that have been in the ATHENS network (Advanced Technology Higher Education Network) for 20 years. This bottom-up network allows about 4,000 students each year students to follow courses in another European higher education institution for one week.

Indeed, İstanbul Teknik Üniversitesi, Budapesti Műszaki és Gazdaságtudományi Egyetem, Universitatea Politehnica din București, Universidad Politécnica de Madrid and four French engineering schools (École des Ponts ParisTech, Mines ParisTech, Chimie ParisTech, ENSTA ParisTech) would like to deepen their cooperation in order to propose their

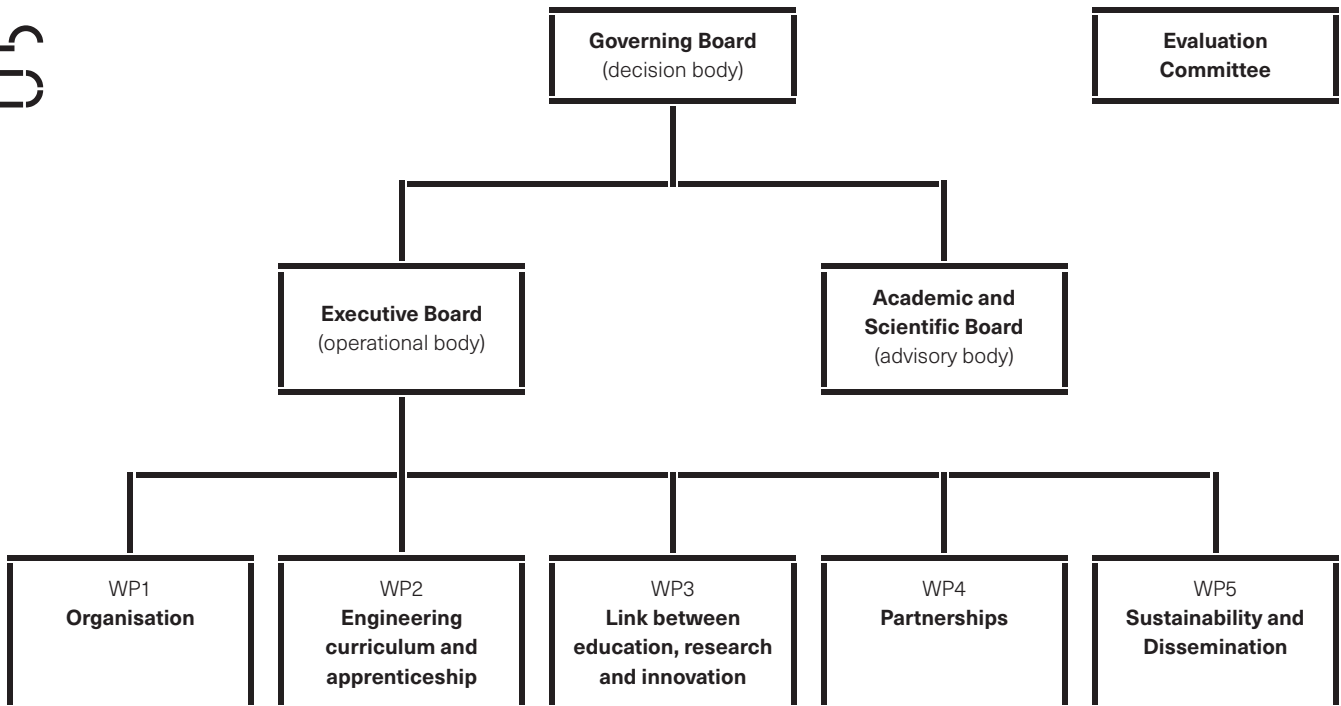
students the opportunity to obtain a European degree and to increase their competences and employability so that they can work anywhere in Europe. EELISA will boost interdisciplinarity, sustainability and link to the industry, thanks to the knowledge, know-how and skills developed by all of its founding members, including Friedrich-Alexander-Universität Erlangen-Nürnberg, a comprehensive university. ENAEE will be our main professional partner.

Our 9 higher education institutions in EELISA represent more than 170,000 students, and more than 35,000 graduates each year.

The governance

EELISA governance will be smart, flexible and lean. Each partner is represented in the decision and advisory bodies. The stakeholders (academic and administrative staff, students) will also be represented in each decision and advisory body through some delegates to be elected at consortium level by all concerned people.

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The governance bodies will use digital processes as much as possible and the partner institutions are ready to test the European Student Card in order to facilitate the mobility of their students.

Our targets

European Union is on the way to convergence between European Higher Education Area (EHEA) and European Research Area (ERA). We believe that

we can support this convergence by designing first a new framework enabling the definition of a European Engineering Degree within the Bologna process and within - or even beyond - EUR-ACE framework set by ENAEE -, and then work together to build bridges between bachelor, masters and PhD degrees.

The following chart summarizes EELISA general work schedule until 2025:

2019

Erasmus+agreements and some double degree agreements (before submission).

2020

Bilateral double degrees agreements between all consortium partners (before September 2020)/preparation of a charter for automatic recognition of credits and degrees.

2025

A European engineering degree.

2019/20

Preparatory discussions.

2020

Apprenticeship in some partners institutions.

2025

Part-time studies in all partners institutions

2020

Engineering/Master degree.

2021

PhD.

2025

Bachelor.

European universities aim an impact on at least 50% of students within the alliance in the three cycles (bachelor, master and doctorate) at the 2025 horizon. The present call supports actions for the first three years (until 2022) that need to show that the cooperation rises in good pace and would meet the objectives for 2025.

In order to achieve this challenge, EELISA aims to create new degrees and renew existing degrees accrediting them by EUR-ACEs. Meanwhile, a common strategy of adopting a genuine “European engineer” shared by all institutions will be defined at the beginning of the project and fully deployed by 2025. This full-scale model (170,000 students and 35,000 graduates per year from 6 different European countries) will enable ENAEE, together with the universities and schools in EELISA to iterate and improve their common standards and processes. Interdisciplinarity, employability and sustainability will be key drivers for this European degree.

EELISA higher education institutions will also open some of their activities to EELISA partners and share best practices in that way in order to enhance the interdisciplinarity dimension and the employability of their students as well as the innovative educational of their staff.

The visibility of this wide cooperation would legitimate the cause for an “European engineer” in terms of impact for citizens and the economy. We intend that our interaction with professional bodies and institutional representatives could make by 2022 that the “European engineer” issue could be included in effective political agenda, and that significant results including a European regulation could be obtained by 2025.

We do not intend to stay only at a strategy level; our targets also include quality processes and performance indicators.

We understand that European universities call complete Erasmus+ programme widening its scope. While other instruments aim a limited number of students (not necessarily few but not as much as 50% for a single activity), European universities mean that a majority of students are engaged within the full perimeter of the partner institutions and beyond. Thus, at EELISA we target to achieve the following:

- By 2022, at least 25% of our students of master level will follow at least one activity including courses of a joint catalogue for all our partners, which will be offered in at least 50% of our degrees,
- By 2025, at least 60% of our students of each level will follow at least two activities of the joint catalogue, which will be offered in all (100%) of our degrees.

Even if EELISA first focus on master/engineering degree level, some activities would be implemented at bachelor and PhD level:

- The students at Bachelor level will be invited to interest themselves for societal challenges, the development of soft skills and Europe;
- The PhD level will be implemented by 2021 in the EELISA strategy knowing that the engineering curriculum consists also in sensibilisation to research, that the EELISA partners already work together in research and want to experiment innovative education for PhD candidates within the ERASMUS+ strategic partnership “Enhancing soft skills through innovative doctoral courses” to be submitted in March 2019 by Mines ParisTech in partnership with most of EELISA partners

Some courses and activities could also be offered as certificates for lifelong learners.

EELISA joint catalogue

EELISA joint catalogue is our main cooperation platform and includes two types of activities:

- On one hand, courses and activities in “semester packages” that allow students to follow an EELISA track during at least two years (master degree / engineering degree) and to gain a double degree or EELISA diploma because they have long-term physical mobility (at least 1 semester) during the curriculum;
- On the other hand, courses and activities which students can follow during a short-term mobility, a virtual mobility or a blended mobility.

These short activities can be building blocks for defining EELISA tracks.

Each partner institution will offer their students activities included in a joint catalogue with the following characteristics:

- They rank from a volume of 2 ECTS to joint 2-years degrees,
- They generally concern all partner institutions and always at least 4 of them,
- They consist on a physical, virtual or embedded mobility in which each particular student gets in contact with others from at least 2 other institutions,
- They concern as well scientific basic and specific courses as soft skills (foreign languages, digital skills, communication, entrepreneurship, management, design, open science etc.).

The “semester packages” include some of these activities so that the student can obtain 30 ECTS in one semester at the same host institution. The “semester packages” can itself include additional mobilities to another institution.

The diversity of this academic offer is firstly encouraged bottom-up with voluntary teachers. Our expectation is to start with about 30 activities from 2020, reach 200 in 2022 and about 600 in 2025.

In order to ensure diversity and quality, EELISA Academic and Scientific board, conducted by its Academic Dean consisting of representatives of all institutions including ENAEE, will approve and evaluate the catalogue with activities offered by faculty from any university or school within the consortium. This board encourages and motivates the following dimensions:



- Cooperation –physical when possible- between faculty from different institutions that offer the same or connected courses,
- Gender balance and social equity among faculty (in order to set examples in this highly visible element of the curricula),
- Renewed or experimental pedagogies, especially oriented to showing students the social impact of engineering and enhancing their employability by gaining experience in companies, with a special attention to problem-based courses, team or individual projects, traineeships, internships and other collaborations with companies and public administrations, as well as the development of soft skills, especially in entrepreneurship and other initiatives of students,
- Multilingual learning by studying or working in a lab or a business in the frame of an internship,
- Diversity within this academic offer that will raise flexibility in the different curricula,
- More cross and multidisciplinary approaches, as they are natural connected to activities that are not reduced to knowledge transfer but more to social and economic challenges solving.

A special attention will be paid to inclusiveness through an apprenticeship track for the European engineering degree, combining in-company paid work and part-time academic courses through the entire curriculum. Apprenticeship will also contribute to innovative education as far as it introduces specificities: an advanced pedagogical engineering based on a skills approach, a new type of evaluation of the learning outcomes, a new training stakeholder (the apprenticeship tutor).

As far as apprenticeship is not so well developed through Europe, the implementation would be progressive: the higher education institutions implementing the apprenticeship pathway would propose it within EELISA by 2019. The other institutions will aim at proposing it by 2025 so that they have time to negotiate with national authorities the legal framework needed for implementing it in their respective countries.

In all cases, European mobility for company or laboratory internships will be encouraged. This will be implemented together with dedicated activities about entrepreneurship.

EELISA roadmap: The Sustainable Development Goals

In order to structure and monitor this catalogue we will use the Agenda 2030 for Sustainable Development Goals (SDGs); this approach has three advantages:

- Political relevance: the SDGs were introduced by United Nations, and the European Union fully committed as well in the European Council meeting in October 2018,
- Scientific relevance: new research programmes (European and national) are now aligned to this challenge-based approach,
- Well-established detailed structure (17 goals subdivided in 169 targets) which facilitate an effective breakdown and coordinated follow-up of hundreds of activities.

About half of these SDGs targets have a direct technological dimension, while the other regard more directly social feasibility (which is also an important aspect of our universities). We intend to show the role of engineering schools and technological universities, not only as specialised experts in some fields, but also as integrators (bridging from science to society). The comprehensive university within the alliance will play a major role to enable this integration. Therefore, some activities fall in line with the industrial needs (internships, technology projects...) so that students can address societal challenges and have at least one experience in the “real world” setting of a company.

EELISA drivers: interdisciplinarity, employability and sustainability

To implement the roadmap, EELISA will use three key drivers: interdisciplinarity, employability and sustainability. Activities will build bridges between different academic and professional communities to build a true interdisciplinarity. For instance, we will develop common training curricula for young high-level professionals in the fields of engineering with management or cultural heritage (sustainability of materials).

That is why we will start with two major challenges to develop common degrees: Smart, Green and Resilient Cities, and Industry 4.0.

At long term, EELISA will be in a key position in Europe enabling different networks to speak together so that we can demonstrate the outstanding benefits of interdisciplinary and sustainability in curricula and organisations.

Interdisciplinarity and sustainability will enhance the employability of the students. Regarding employability, there is also a need to understand whether the issue of mobility of the graduates and the recognition by the employers is the same for Bachelor and PhD than for master level.

EELISA tracks and European degree

As a major objective within EELISA joint catalogue, and in order to structure the entire pedagogical offer, “EELISA tracks” will be defined within the different degrees in each university or school. It means that students within their degree will do some predefined blocks of physical, virtual or blended mobility within the EELISA catalogue.

EELISA tracks will be first implemented via double degrees and an EELISA charter for automatic mutual recognition of higher education qualifications and the outcomes of learning period abroad between consortium members. Double degree agreements are intended to be signed to create more opportunities for students. In that case, students will be awarded two degrees in a similar way of any international/European double degree members are used to implement.

By the end of 2021:

- EELISA members will have at least two EELISA tracks at master level
- Mobility within already signed double degree programmes will be doubled

By 2025:

- Each degree level (bachelor, master and PhD) should include at least one EELISA track
- All members will have signed double degree agreements with each other and applied for accreditation of a full European degree EELISA

EELISA tracks could be variants of the following example, extended to full bachelor, master and PhD degrees, only one of them or even combinations as it is illustrated below:

France	Germany Hungary	Romania Spain Turkey	Semester	Curriculum
		Bachelor 1	1&2	University in home country (A): possibility of some introduction to EELISA courses
CPGE 1	Bachelor 1	Bachelor 2	1&2	University in home country (A): possibility of some introduction to EELISA courses
CPGE 2	Bachelor 2	Bachelor 3	1&2	University in home country (A): possibility of some introduction to EELISA courses
Year 1 at school	Bachelor 3	Bachelor 4	1	University in home country (A): common/basic courses+language courses
			2	University in home country (A): common/basic courses+language courses
Year 2 at school	Master 1	Master 1	1	University in host country (A): common/basic courses+language courses
			2	University in host country (A, B, C, D, or E) +mandatory internship
Year 3 at school	Master 2	Master 2	1	University in host country (A, B, C, D, or E): specialisation or/and internship in a lab
			2	Internship (6 months) under supervision on A in one of the consortium country or another (even outside of Europe)
EELISA master/engineering degree				
PhD			6-8 semesters	Specific doctoral programme

To achieve our objective to enable students and engineers moving freely within the European Union, EELISA will target to develop a new genuine European Engineering Degree. By sharing resources, members will design a new curriculum, with two initial challenge-based specializations: Smart, Green and Resilient Cities, and Industry 4.0, as mentioned earlier.

Conclusion

We believe it is time to consider engineers as the next major step toward the European Higher Education Area where students and engineers can study, work, and move across Europe without any constraint.

National level specificities should be a richness in terms of technical specialization or design variety, but never a barrier in terms of accreditations or permissions. It is now time to strengthen our ties to make our students and professionals fully aware of European citizenship in terms of mobility, cultural exchange and economic opportunities.

Our 9 universities and graduate engineering schools are considered in our countries excellent research and education institutions. We built our curricula with research activities. We have developed strong links with businesses. We already collaborate at all level thanks to bottom-up initiatives. Innovation in education and research is in our shared vision.

The link between education, research and innovation can be reinforced thanks to the development of innovative trainings shared among us and with everyone interested. In addition, we will develop a new European curriculum in engineering so that our students are the best equipped to tackle societal challenges and contribute to achieve the Sustainable Development Goals as well as to increase economic growth in Europe and develop their civic engagement.

For the long-term success of EELISA, we will join our forces to build up research and innovation collaborations. We have decided to focus on Smart, Green, Sustainable and Resilient Cities and Industry 4.0, as challenges that integrate the whole perspective of our society needs of innovation in the field of engineering and connected disciplines.

We are committed to inclusiveness. We have chosen apprenticeship as the most effective tool to benefit from our rich network of industrial relations, so that we can set genuine part-time curriculum across Europe which includes a remuneration during the engineering studies.

Collaborating at all levels and participate in common networks, EELISA will be achieved involving all stakeholders from students to directors, research, teaching and administrative staff. We will define an efficient governance that enables cooperation among colleagues, as fluid as with colleagues in the same institution and country. An annual stakeholder conference will showcase the work performed in EELISA and allow everyone in the alliance and beyond to share best practices and to reflect together to improve the implementation of our strategy.

In 2025, it is aimed that more than half of our students will benefit from a mobility experience and all may benefit from EELISA activities, through a common strategy for diploma accreditation following ENAEE's EUR-ACE standards and thanks to the new European Engineer framework combining studies in several European countries.

So, the EELISA model might be broadened to other degrees and professional occupations in the future, even extended to other professions and degrees offered by comprehensive universities from 2021 if possible.

Thus, as Rectors and Directors, we commit our universities and graduate engineering schools to join our strengths to reinforce Europe through the creation of our European Engineering Learning Innovation & Science Alliance.

EELISA partners:

Rector, Budapesti Műszaki és Gazdaságtudományi Egyetem

Director, École Nationale Supérieure de Chimie de Paris

Director, École Nationale Supérieure de Techniques Avancées

Director, École Nationale des Ponts et Chaussées

Director, École Nationale Supérieure des Mines de Paris

Rector, Friedrich-Alexander-Universität Erlangen-Nürnberg

Rector, İstanbul Teknik Üniversitesi

Rector, Universidad Politécnica de Madrid

Rector, Universitatea Politehnica din București

ELISA associated partner:

President, European Network for Accreditation of Engineering Education
