



JEDI The JEDI label: guidelines for application to joint degrees

Deliverable D3.2

Date: March 2024

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The JEDI label: guidelines for application to joint degrees

Project title: Joint European Degree Label in Engineering – Toward a European Framework for Engineering Education

Project acronym: JEDI

Grant agreement: 101114604

Due date: 31/01/2024

Actual submission date: 27/03/2024

Project start date: 01/04/2023

Duration: 12 months

Work package concerned: WP3

Concerned work package leader: UNIVERSIDAD POLITÉCNICA DE MADRID UPM - (SPAIN)

Dissemination level: PU ¹

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¹ PU – Public; PP - Restricted to other program participants (including the Commission Services); RE - Restricted to a group specified by the consortium (including the Commission Services); CO - Confidential, only for members of the consortium (including the Commission Services).

HISTORY OF CHANGES

Version	Publication Date	Status	Authors
Version 1.0 (draft)	--	Initial Draft and Table of contents	UPM
Version 1.1 (draft)	04/03/2024	Second draft	UPM & All partners
Version 2.0	22/03/2024	First version	UPM & All partners
Version 3.0	27/03/2024	Second version	UPM

JEDI Partners

Name	Short name	Country
UNIVERSIDAD POLITÉCNICA DE MADRID	UPM	Spain
ÉCOLE NATIONALE DES PONTS ET CHAUSSÉES	ENPC	France
ISTANBUL TEKNİK UNIVERSİTESİ	ITU	Turkey
UNIVERSITATEA POLITEHNICA DIN BUCURESTI	UPB	Romania
BUDAPESTI MUSZAKI ES GAZDASAGTUDOMANYI EGYETEM	BME	Hungary
UNIVERSITE DE TECHNOLOGIE DE TROYES	UTT	France
HOCHSCHULE DARMSTADT (UNIVERSITY OF APPLIED SCIENCES H-DA)	H-DA	Germany
UNIVERSIDAD POLITECNICA DE CARTAGENA	UPCT	Spain
TEHNOLOGIKO PANEPISTIMIO KYPROU	CUT	Cyprus
TECHNICAL UNIVERSITY OF SOFIA	TU-SOFIA	Bulgaria
UNIVERSITATEA TEHNICA CLUJ-NAPOCA	UTC	Romania
CHALMERS TEKNISKA HOGSKOLA AB	CHALMERS	Sweden
UNIVERSITE PARIS SCIENCES ET LETTRES	PSL	France
UNIVERSITAT POLITECNICA DE VALENCIA	UPV	Spain
RIGAS TEHNISKA UNIVERSITATE	RTU	Latvia
TECHNOLOGICAL UNIVERSITY DUBLIN	TU-DUBLIN	Ireland

JEDI Executive Summary

In the field of policy experimentation in higher education under the Erasmus+ program, the Joint European Degree Label in engineering (JEDI) is part of the 2022 Erasmus+ Work Program call. The general objective of JEDI is to develop a prototype label for European joint degrees, co-developed with 16 HEIs from three European Universities (EELISA, EUt+ and ENHANCE) and under the perspective of engineering, technology, and science-oriented education. The added value of this project is built on the shared ambition of this consortia to redefine the education of engineering and technology degrees in Europe with the will to contribute to the development of an integrated European Engineering Education Space.

The project is based on the collaboration and discussion between agencies, academia, and diverse stakeholders. To ensure visibility and engage students, JEDI will create three co-labs for the decisive steps of validation and demonstration. All the partners, including associate partners, will appoint experts and stakeholders (e.g., HEIs, associations, students, and accreditation agencies) that will contribute to the optimisation of the set of criteria.

JEDI is a one-year project structured around four work packages (WPs), as depicted in the schematic. WP4 has three crucial objectives: to communicate the project and its results, to disseminate the outcomes towards the people responsible for joint degrees (in our HEIs and in external consortia) and to prepare recommendations for policymakers, accreditation agencies and European HEIs interested in implementing this label. This project has not received any additional funding from the three European Universities; the costs have been paid by EU funding and partners.



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2 About the deliverable

D3.2 deliverable aims at producing for the JEDI label guidelines for its application to Joint European Degrees.

The document is organized as follows:

Section 3 presents the methodology, objectives and hypothesis used in the focus group meeting, and the interaction with joint degrees owners, along with the participant in both actions.

Section 4 discusses about the European Degree criteria defined by European Commission with the participation of the policy experimentation projects. It also includes a discussion about the draft pathways raised by EC as potential implementation of label a Joint European Degrees.

Student-centred learning approaches for Joint European Degrees in engineering are presented in section 5. The innovative learning approaches aim at defining a framework for engineering education in joint degrees under the framework of the European criteria.

Section 6 describes the JEDI approach for Joint European Degrees. An analysis of a potential framework for the design of joint programmes considering all the required criteria and participation of Quality Assurance agencies and diverse inputs for learning outcome, including stakeholders. In addition, possible implementation pathways for the Joint European Degrees in engineering are presented in detail.

Section 7 analyses the current context of regulated professions in European, and how the accreditation and joint programme design can be streamlined to harmonize a European approach for joint degrees allowing the practice of regulated professions.

Section 8 presents the academic strategy of the alliances involved in the JEDI project (EELISA, EUt+ and ENHANCE) and its alignment with Joint European Degrees.

Section 9 draws the conclusion of the JEDI project in terms of guidelines and design of Joint European Degrees in engineering, science and technology disciplines.

All the references used in the elaboration of the deliverable are included in section 10.

Annex 1 contains the material used in the focus group on the design and implementation of the JEDI label.

Annex 2 lists the joint degrees that have participated in the survey for the application of the JEDI label.



Finally, Annex 3 shows the results drawn from the survey to joint-degrees owners regarding the reflection on the application of European criteria.

The contents of this deliverable have been built on the inputs of the focus groups, the survey and interviews with joint degrees owners, as well as a thoughtful analysis of the European Degree criteria and the proposed draft pathways towards the joint European degree label or joint degree itself. Finally, additional enriching inputs from the discussions during the JEDI final event held in Madrid during 14th and 15th of March 2024, have been incorporated.



3 Methodology, objectives, and hypothesis of the collected information

After analyzing the surveys, reflecting on the feedback from colabs, and drafting D3.1 [1], D3.2 encompasses the following activities carried out since November 2023 with external members to the project:

- Meeting with joint degree owners (18/01/2024): Debate between members of JEDI and some representatives of existing joint degrees in the European science, technology, and engineering market to discuss the feasibility of applying the JEDI label and its components for proper implementation and understanding within the academic community.
The meeting with the joint-degree owners was partly based on the sending of a survey to the representatives. The survey aimed to analyze the suitability of the criteria proposed by the European Commission for the joint degrees in which the JEDI label implementation is intended.
- Focus group on the design and implementation of the JEDI label (22/01/2024): Bringing together various stakeholders (student representations, accreditation agencies, university representatives from third countries, etc.), JEDI members have discussed two main themes with them:
 - On the proposed delivery process for the European joint degree label, contemplating alignment with existing EUR-ACE procedure.
 - On the importance of considering innovative techniques and practices as a competency-based approach, relying on project-based and experiential learning involving academic partners and stakeholders of various kinds.

The conclusions drawn from both sessions have been pivotal for the development of this deliverable and have been made in parallel with the work carried out by WP4 through focus groups for the long-term construction of the proposal.

3.1 Focus group on the design and implementation of the label

In order to gather information from an audience external to the project and to assess its feasibility with various interested and concerned categories, a focus group was organized at the end of January 2024, along with some members of JEDI. The participants in the session were contacted through the responses of interest from the surveys of the collaborators in relation to the drafting of D3.1.

The purpose of bringing together these participants stemmed from the need to understand and collect data on the knowledge, dissemination, and feasibility of the JEDI project before an audience that could be highly involved in the construction of the project yet somewhat unaware of the objectives of the label. In order to facilitate the exchange, stakeholders from different categories (student

representation, accreditation agencies, and academic representation from a third country) were gathered to discuss the following topics (the questions are included in the annex):

- Context settings about the label and the Joint Degrees.
- European Union criteria.
- European framework: mobility.
- European framework: innovation, transnational campus, digitalization.
- Image, identity, and dissemination of the label.
- JEDI proposal on the label.

3.1.1 Participants in the focus group

The participants were:

- Commission des titres d'ingénieur (France) – Executive Director.
- Central Evaluation and Accreditation Agency Hanover (ZevA – Germany) – Managing Director.
- Instituto Tecnológico de Monterrey (Mexico) – Director of Academic Delegation in Madrid.
- EELISA Alliance (Germany) – Student representative.

3.1.2 Results and conclusions of the focus group

The material used in the focus group is included in Annex 1.

The focus group addressed topics related to the design and implementation of the European Joint Degree Label in Engineering. The main points are listed below:

1. Delivery of a European Joint Degree Label: participants were asked about the feasibility of including the evaluation of the label as a separate part of another evaluation process (e.g. during a EUR-ACE label awarding evaluation). In principle, it was considered possible, and interesting to reduce the associated costs, but some difficulties were pointed out: there are several frameworks to be evaluated and no clear rules about if the degree could be awarded one label and denied another. The second problem is that the European Joint Degree label provider is yet to be defined.

Universities are cost-conscious in a growing market of labels and only those which can provide added value will survive. This is closely related to recognition: it should be adopted by enough institutions and known by employers.

2. Certificates. There is no conflict between printed diplomas or digital certificates. Printed diplomas are typically a requirement in national regulation, even with a registry code issued by the Ministry in each country.

Digital certificates so far are only associated to short learning experiences and will grow due to the promotion of microcredentials. Higher Education Institutions will probably issue both of them at the end of each degree.

3. Joint degrees: from scratch-design vs. adapting existing degrees. Participants agree that the European Commission is interested in joint degrees, although they are considered costly by universities in terms of the resources needed to create them. Programs created from scratch are more difficult to design, but easier to maintain. Conversely, adapting titles may be easier and this option can bring more students from the beginning, but effort must be done in order to align the learning outcomes and the admission criteria. Every case may have a different environment and constraints, so Universities and alliances should study each case separately. Accreditation agencies are willing to allow some degree of institutional experimentation within the European framework.
4. Innovation in education: it is accepted that all innovative approaches should be student centered. Given the fact that program accreditation is competency-based, it is necessary to assess competence acquisition when innovative strategies such as challenge-based or research-based learning. The representative of Tecnológico de Monterrey (México) provided information about their experience with challenge-based learning: competencies are progressively acquired over several challenges. It is important to map activities into competencies. For each challenge, knowledge and competencies should be matched.
5. Interdisciplinarity. Since interdisciplinarity is typically not a requirement for accreditation, and its associated contents and skills are not explicitly listed as learning outcomes, few programs allocate space for it (maybe with the exception of economy and management in many engineering degrees). Interdisciplinary contents are often found associated to extracurricular activities or courses across faculties. Interdisciplinarity is now beginning to be taken into consideration by University rankings, so HEIs might well pay more attention to it.
6. Mobility. A full semester abroad is the current Erasmus standard. It has also been adopted by some accreditation agencies (in France, 17 weeks are required in many programs). This ensures a real immersion and students have always considered it as an enriching experience. Short mobility activities such as BIPs of seasonal schools are also well valued by students, by they struggle to find time. They also provide a good framework for interdisciplinary activities. In fact, mobility is closely linked to interdisciplinarity, and students would like to have both of them embedded within their degrees rather than a mere consideration as extracurricular activities.

Other considerations arising from JEDI's closing event:

- Joint degrees are more relevant for universities (and probably for the society at large) that joint degree labels.
- They can be designed from scratch or by adapting existing titles, but it is always crucial to pay attention to the formulation of the learning outcomes and admission criteria.
- It will always be easier to begin with programs that are not associated with regulated professions.
- There are challenges for some actors to manoeuvre with national regulation authorities and find ways to overcome difficulties. Designing and implementing European joint degrees is possible and is feasible.

3.2 Meeting with joint-degrees owners

The meeting brought together members of JEDI along with the following representatives of joint-degrees with the purpose of discussing the feasibility of the project and extending an invitation for participation in the implementation of the JEDI label for joint degrees.

3.2.1 Participant Joint degrees

The meeting brought together members of JEDI along with the following representatives of joint degrees with the purpose of discussing the feasibility of the project and extending an invitation for participation in the implementation of the JEDI label for joint degrees:

- Master in Global Challenges for Sustainability.
- Erasmus Mundus European Joint Master's Degree in Electric Vehicle Propulsion and Control (E-PiCo).
- Joint Master in Bio Marine Technology.
- Erasmus Mundus in Sustainable Transportation and Electrical Power Systems.

Annex 2 includes the details of the participant joint degrees.

3.2.2 Conclusions from the Joint-Degrees owners

Before the scheduled meeting with the joint-degrees owners, a form was circulated to assess the applicability of European criteria to existing joint-degrees. Following the European criteria developed within the framework of pilot projects, joint-degrees owners were required to analyze whether their study programs met the proposed criteria.

Thanks to the collected results, the discussion could focus on the changes that could be implemented, questioning the current structures that shape joint degrees in regulated professions. The survey disseminated to the joint-degrees owners was based on the criteria disseminated by the European Commission in the first part of the call, with the necessary modifications disseminated at the beginning of 2024.

In Annex 3, we note the conclusions drawn regarding the responses from joint-degrees owners regarding the reflection on the application of European criteria. As we can clearly see, criteria such as the implementation of mobility in doctoral programs, inclusivity and sustainability, or transnational access to campus are not implemented in existing joint-degrees, necessitating a reconsideration of the current curriculum structure. Additionally, implementing criteria such as joint-degree delivery or monitoring graduate outcomes are elements that joint-degrees owners find challenging to materialize, sparking debate on the path joint-degrees should take if we aim to uniformly apply a set of requirements.

4 EU framework: European Union criteria and initial proposal on the European Degree Label

4.1 Discussion on the European Degree criteria

Table 1 presents the final draft of the European Degree criteria proposed by DG-EAC after the meeting with pilot experimentation projects on February 8th in Brussels and updated on February 12th [1].

Table 1. European Degree (label) criteria (version of February 12th, 2024).

European Degree (label) criteria			EQF Levels
Transnational programme organisation and management	Higher education institutions involved	The joint programme is offered by at least 2 higher education institutions from at least 2 different EU Member States.	6, 7, 8
	Transnational joint degree delivery	The joint programme is jointly designed and jointly delivered by all the higher education institutions involved.	6, 7, 8
		The joint programme leads to the award of a joint degree.	6, 7, 8
		A joint diploma supplement is issued to students, providing a comprehensive list of the outcomes that students attain throughout the programme.	6, 7
		The joint programme describes the learning outcomes and credits in line with the ECTS Users Guide.	6, 7
	Joint arrangements for the joint programme	The joint programme has joint structures and/or mechanisms to establish and monitor joint policies and procedures describing the curriculum as well as organisational and administrative matters in accordance to national/regional legislation of all partners. Students' representatives are part of the decision-making process to define the joint policies and procedures.	6, 7, 8
	Quality assurance arrangements	Internal and external Quality Assurance is conducted in accordance with the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). The	6, 7, 8

		institutions, the study field or the programme are evaluated by an EQAR registered agency.	
		The joint programme is evaluated using the standards of European approach for quality assurance of joint programmes (EA).	6, 7, 8
	Graduate tracking	The joint programme monitors graduates through a graduate tracking system.	6, 7, 8
Learning experience	Student-centred learning	The joint programme is delivered in a way that encourages students to take an active role in the learning process, and the assessment of students reflects this approach.	6, 7, 8
	Interdisciplinarity	The joint programme includes embedded interdisciplinarity components.	6, 7, 8
	Labour market relevance	The joint programme aligns with labour market requirements by incorporating intersectoral components or activities and the development of transversal skills.	6, 7, 8
	Digital skills	The joint programme includes components and actions related to the development of advanced digital skills of students, all tailored to the capacities and circumstances of the joint programme, ensuring alignment with its scope and scholarly focus.	6, 7, 8
	Transnational campus – access to services	The programme has joint policies for students and staff to have access to services in all participating HEIs in equivalent conditions as all enrolled students.	6, 7, 8
	Flexible and embedded student mobility		The joint programme offers deep intercultural experience, including a minimum of 1 period of student physical mobility (that can be split in several stays) at another or several partner institution(s) representing overall at least 60 ECTS at EQF 6 level and 30 ECTS at EQF 7 level. The joint programme has a policy offering alternatives for students who are unable to travel.
		The joint programme offers deep intercultural experience, including a total of at least 6 months of physical mobility at another or several partner institution(s).	8

		The joint programme has a policy offering alternatives for students who are unable to travel.	
	Co-evaluation and co-supervision for dissertations	Dissertations are supervised by at least two supervisors and co-evaluated by co-supervisors or a committee with members from at least 2 different institutions located in 2 different countries.	8
European Values	Democratic values	The joint programme’s joint policies promote and adhere to democratic values.	6, 7, 8
	Multilingualism	During the joint programme, each student is exposed to at least 2 different EU official languages.	6, 7, 8
	Inclusiveness	The joint programme commits to wide participation by fostering diversity, equity and inclusion by adopting tailored measures to support students and staff with less opportunities.	6, 7, 8
		The joint programme commits to respect the principles of the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers.	8
	Green transition	The joint programme agrees on policies and actions related to environmental sustainability and implements measures to minimise the environmental footprint of its activities.	6,7
		The joint programme commits to the principles of the MSCA Green Charter	8

From the JEDI project, the following points are discussed:

- Higher education institutions involved: instead of 2, a minimum number of 3 higher education institutions from at least 3 different EU Member States could have been proposed. Considering the structure of European alliances, a minimum of 3 EU Member States involved is clearly possible and would reinforce the European added-value of the joint programme. Moreover, the European strategy for Universities aims to fostering multilateral collaboration [10] and one of the requirements in the Erasmus+ call for European alliances, a requirement of being “HEIs from minimum 3 eligible higher education institutions from 3 different eligible countries” is

set [11]. Finally, legislation in countries (e.g. Spain) consider as international joint degrees the framework of European alliances as those designed with the participation of at least 3 universities of the consortium. An additional reason to incorporate 3 different HEIs in the joint programme is to ensure the multilingualism criterium: there are European countries sharing an official language, making difficult the student be exposed to just one language.

- Transnational joint degree delivery: awarding a joint degree is a major milestone for joint European degrees. For those European university alliances whose academic strategy lies on joint programme, the awarding of joint degrees represents a long-term activities that will foster the long-term sustainability of the alliance.
- Transnational joint degree delivery: issuing a diploma supplement for each student is required to include her or his personal academic pathway achieved. Envisioning that a large and diverse number of academic pathways will be possible in the joint programme, the diploma supplement is a means to provide the individual information if not included in the diploma itself. The particular format of this diploma supplement shall be either defined at European level as a minimum set of information or preferably by each joint programme considering its particularities. Moreover, the diploma supplement of Joint European Degrees must be an enabler to support the recognition of academic qualifications within the European Higher Education Area, which for regulated professions would be a major achievement.
- Student-centred learning: we agree on describing this important criterion from a more general perspective rather than including specific examples of methodologies (e.g. project or challenge-based learning). From the JEDI perspective of engineering, science and technology degrees, it allows more diversity on the particular innovative learning approaches that each partner institution or European alliance may follow in the joint degree. The student-centered learning approaches are driven by the nature and particularities of the joint programme. Finally, although the student-centered learning concept is part of the ESG, in order to generalize and spread the approach, it is important to remark and highlight it explicitly as a separate criterium.
- Transnational campus – access to services: to support the mobility of students and staff, and to reinforce the participation of staff in the joint programme not only at their home institution but in any of the partner institutions, is a major improvement of the criteria.
- Flexible and embedded student mobility: it seems adequate to include mobilities of at least 60 ECTS for EQF 6, 30 ECTS for EQF 7 and 6 months for EQF 8 in order to reinforce intercultural and multilingualism aspects. As well, policies to offer alternatives for students unable to travel will imply

innovative solutions in the design of the joint programme that will be agreed by the HEIs involved in the joint programme design. Solutions based on European BIP (Blended Intensive Programs) [17], worldwide COILs (Collaborative Online International Learning) [18], already in place successfully in several European Universities, or other actions could be included a part of the joint programme to combine short-term mobilities with blended learning.

- **Interdisciplinarity:** in a rapidly changing world, where technologies tend to converge and benefit from complementary approaches, interdisciplinarity is a major requirement for engineering, science, and technology degrees. Moreover, engineering degrees accredited with the EUR-ACE label must comply with Engineering Practice (“the ability to integrate knowledge from different branches, and handle complexity”) and Transferable Skills (“function effectively as leader of a team that may be composed of different disciplines and levels”) [19]. However, this criterium as it enunciated is not wide or open enough to include other approaches such as multidisciplinary. Although there is some misunderstanding about the differences between both terms, they can be considered as complementary. Figure 1 clarifies the differences between both concepts. On the one hand, an interdisciplinary approach relies on shared knowledge by a team of professionals with different backgrounds or expertise that interact and work collaboratively. Some well-known disciplines such as biochemistry or neuroscience have emerged from interdisciplinarity. On the other hand, multidisciplinary takes place when persons from different disciplines work independently on a common problem, research, or study question. In this approach, people share goals and work on the same problem, but look at it from their own discipline’s perspective. Each discipline has its own voice in a harmonization approach.



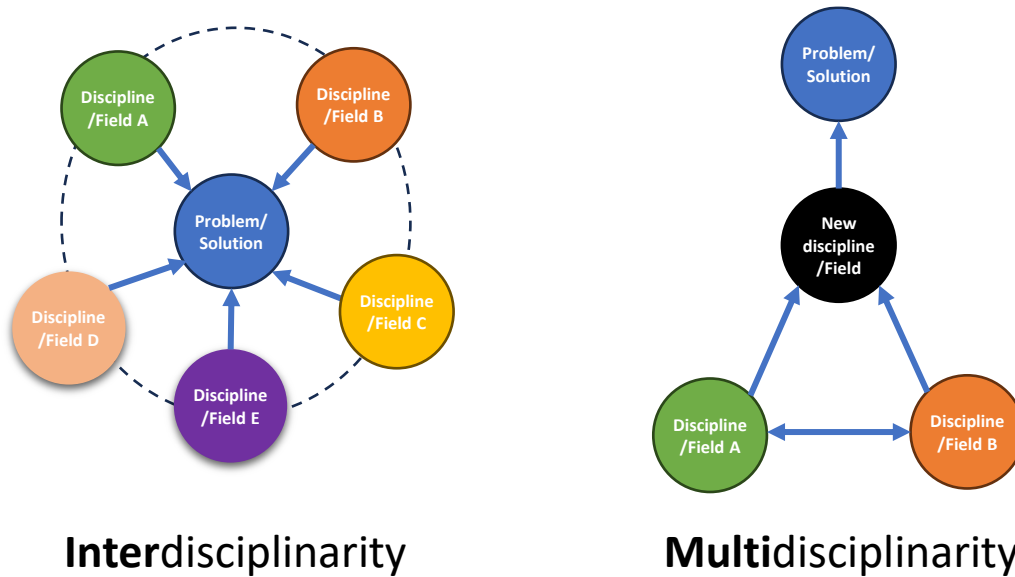


Figure 1. A comparison of multidisciplinary and interdisciplinary (adapted from [13]).

- Digital skills: although digital skills are needed in any discipline, for engineering, science, and technology degrees the acquisition of digital skills and competences (Digital literacy, Digital numeracy, Computer literacy, Data literacy) is of major interest for the professional careers of students.
- Multilingualism: in its current description, exposure to at least 2 different EU official languages seems to be more practical and flexible. Exposure to multilingualism might take different forms, from daily life exposure to language classes or regular courses provided in a second language, and all will contribute to leverage the European added value of the joint programme. An additional language could have been included in the criteria in case more than 2 institutions are involved in the joint programme. Finally, it is important to mention that academic pathways within the joint programme could eventually require language requirements. In addition, some European Alliances such as EU+ already include language requirements: B2 for bachelor degrees in a foreign language and B1 in another language for the Master degree [12].
- Green transition: engineering, science and technology degrees plays a major role in the implementation of policies and actions related to environmental sustainability and minimize the environmental footprint of the activities. Some examples already exist in European universities towards net zero carbon campuses smartly combining different technologies and disciplines. However, to make the sustainability commitment more impactful, we propose below including the term “impact” instead of “environmental footprint”, as the polices taken the joint

programme have a wider dimension than only environmental. This criterium will also be linked to embedded mobility: semester or annual stages instead of numerous short term mobilities must be boosted for the sake of reducing the footprint of the joint programme activities.

- Co-evaluation and co-supervision for dissertations: this criterium is currently applicable to joint doctoral degrees (EQF 8). Considering the common practice of including Bachelor and Master thesis as part of the joint programme, this criterium could be extended to EQF 6 and 7. It will strengthen the collaboration between faculties and researchers of involved HEIs (very relevant for engineering, science, and technology degrees)
- Democratic values: in its current form, the policies of the joint programme promote and adhere to democratic values without any assignment of ECTS. In the engineering, science and technology degrees, having ECTS devoted to democratic values would be challenging, so from JEDI we support the new declaration of the criterium. From JEDI, we strongly support the separation of democratic values and inclusiveness, which shall be linked to joint programme policies (e.g. scholarships for the most disadvantaged students, admission criteria), and the student workload in ECTS.

Table 2 summarizes the proposed modifications for the proposed European Degree (label) criteria based on the previous discussion.

Table 2. Proposed modification of European Degree (label) criteria (relative to version of February 12th, 2024).

Criterion	Original	Proposed modification
Higher education institutions involved	The joint programme is offered by at least 2 higher education institutions from at least 2 different EU Member States.	The joint programme is offered by at least 3 higher education institutions from at least 3 different EU Member States.
Interdisciplinarity and multidisciplinarity	The joint programme includes embedded interdisciplinarity components.	The joint programme includes embedded interdisciplinarity and/or multidisciplinarity components.
Co-evaluation and co-supervision of dissertations	Dissertations are supervised by at least two supervisors and co-evaluated by co-supervisors or a committee with members from at least 2 different institutions located in 2 different countries. (EQF 8)	Dissertations are supervised by at least two supervisors and co-evaluated by co-supervisors or a committee with members from at least 2 different institutions located in 2 different countries. (EQF 6, 7, 8)
Green transition (Environmental sustainability)	The joint programme agrees on policies and actions related to environmental sustainability and implements measures to	The joint programme agrees on policies and actions related to environmental sustainability and implements measures to

	harmonize the environmental footprint of its activities.	minimise the impact of its activities.
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Some additional criteria that would reinforce the scope of the joint degree approach are described below (Table 3):

- Promotion and visibility: in the original criteria this criterium was proposed as optional. However, to ensure the visibility for all the involved stakeholders (students, employers). Moreover, for the sake of transparency, open information of the joint policies should also be publicly available.

Table 3. Additional European Degree (label) criteria (relative to version of February 12th, 2024).

Additional European Degree (label) criteria			EQF level
Transnational programme organisation and management	Promotion, public information and visibility	The higher education institutions offering the joint study programme conducts joint promotion and awareness raising activities to ensure visibility of the joint programme and provide the necessary information about it for students and other relevant stakeholders such as future employers.	6, 7, 8

4.2 Discussion on the draft pathways towards a joint European Degree

Three academic pathways have been proposed by DG-EAC to award a European Degree as a label [13]: the Joint European Degree label pathway, the Joint European Degree pathway and the European Degree pathway.

In the following paragraphs we will discuss about the three alternative pathways. The three pathways share a common requirement which is the delivery of a joint degree which relies on a jointly designed and jointly implementation of a joint programme by all the higher education institutions involved. It is important to remark this feature as the delivery of the joint degree is one of the major challenges towards the European Degree label.

Considering the scarce number of joint degrees in Europe, it is critical to reinforce and clarify the pathways towards facilitate the implementation of joint programmes leading to Joint European Degrees. [14] In the survey of 459 joint programs in the EDLab project [11], 71% of JPs award a double degree, while less than 18% award a joint degree. This situation is even more critical in engineering disciplines, where very few joint degrees have been surveyed in [15]. In [14], the percentages of joint programmes in Engineering, manufacturing and

construction, Information and communication technologies and Natural sciences, mathematics and statistics are 17.6%, 3.1% and 19.6%, respectively. For regulated professions, existing joint degrees are rather scarce, with less than 5% of the review engineering programmes in [15].

In addition, as shown in [14] and [15], joint programmes leading to a Master joint degree represent a vast of majority of the existing joint degrees, implying that further efforts at European level to support Bachelor and Doctoral joint degrees are needed.

4.2.1 Joint European Degree label pathway

The Joint European Degree label pathway is summarized by DG-EAC in Figure 2.

Joint European Degree label pathway

Joint European degree label	
Description	Joint European degree label certificate given to students graduating from joint degree programmes that meet the European criteria.
Students	Receive a joint European degree label certificate (on top of their diploma(s)) with names and logos of participating HEIs and alliance where relevant.
HEIs consortium	Determines in a consortium agreement the HEI that will coordinate the label certificate delivery.
Accreditation/ compliance check with European criteria	By an EQAR-registered agency or by HEIs that can self-accredit their own programmes (provided that their internal QA system respect the criteria and guidelines for the award of a joint European Degree label).
National legislation	Allows national QA agencies to carry out evaluations of criteria compliance as part of their accreditation/QA procedures.



Figure 2. Joint European Degree label pathway.

The Joint European Degree label pathway represents a label certificate whose validation across Europe is not guaranteed. For regulated engineering professions, this would not be a valuable option as our ambition is to have Engineering degrees recognised across Europe.

From the JEDI perspective, considering we focus on engineering degrees and the existing EUR-ACE label from ENAEE, this Joint European Degree label could be integrated in EUR-ACE just by complementing the engineering programme outcomes of EUR-ACE with the European Degree criteria. Those joint degrees without EUR-ACE label should include the evaluation of European criteria compliance as part of their Quality Assurance system.

This Joint European Degree label would be applicable for existing joint degrees that can be adapted to comply with the European Degree criteria.

4.2.2 Joint European Degree pathway

The Joint European Degree pathway is summarized by DG-EAC in Figure 3.

Joint European Degree	
Description	Joint European degree embedded in national legislation as a new type of qualification, based on European criteria. It is automatically recognised across the EU.
Students	Receive a joint European degree diploma that specifies names and logos of participating HEIs and alliance where relevant.
HEIs consortium	Determines in a consortium agreement the choice of the HEI that will coordinate the delivery of the joint diploma.
Accreditation/ compliance check with European criteria	By EQAR-registered agency or by HEIs that can self-accredit their programmes.
National legislation	Integrates the joint European degree as a new type of qualification in National Qualifications Frameworks/law.




Figure 3. Joint European Degree pathway.

The Joint European Degree is the most attractive and convenient pathway for JEDI as it leads to the recognition of the degree across Europe. For regulated engineering professions, it would be an opportunity to define a set of common requirements for these engineering degrees that will facilitate the design of the joint programme and the awarding of the joint degree.

In terms of the academic design of the joint programme and in order to fulfil the European Degree criteria, we highlight:

- 1) A set of common learning outcomes should be defined per semester or per year, in order to facilitate the mobility of students in any semester of the joint program. Thus, each institution involved in the joint programme design each semester under the framework of European Degree criteria while maintaining the organization of academic activities and student-centered learning approaches. The consortium agreement shall guarantee the automatic recognition of the credits achieved by the students at any institution during the mobility.
- 2) A minimum number of ECTS realized in mobility should be guaranteed: 60 ECTS in EQF 6 and 30 ECTS in EQF 7, and 6 months for EQF 8. As well, alternatives to students unable to travel should be offered in EQF 6, 7 and

8 degrees. This strong incentive for long-term physical mobility, as the best tool for intercultural training, could be complemented by the possibility of hybrid and/or virtual mobility, or shorter physical mobility. These options could be particularly relevant for short-term (1-year) and/or executive education-type programs.

However, there is a major challenge that must be overtaken: the integration of the joint European degree as a new type of qualification in National Qualification Framework. Beyond the academic perspective, this is a political decision from the member states which may produce an unbalanced situation in Europe between countries operating under different regulatory frameworks. If Member States adhere to ESCO² (European Skills, Competences, Qualifications and Occupations) approach, it will facilitate the integration.

In addition, a logo of the Joint European degree should be created and agreed at European level to reinforce the visibility and knowledge of the degree.

From JEDI, we appreciate the transformative approach of this second pathway and consider it is achievable in the long-term based upon the willingness of European alliances to deliver joint degrees in engineering, science, and technology.

4.2.3 European Degree label pathway

The European Degree label pathway is summarized by DG-EAC in Figure 4.

European Degree pathway	
	European Degree
Description	European Degree embedded in national legislation as a new type of qualification, based on European criteria. It is automatically recognised across the EU. Alliances have established a legal entity that can be accredited to design and deliver joint educational provisions, including European degrees.
Students	Receive a European degree diploma.
HEIs consortium	Establishes a legal status for their alliance that can be accredited to deliver joint educational provisions, including a European degree.
Accreditation/ compliance check with European criteria	Accreditation of the legal entity is done by an EQAR-registered agency. Alliances can then self-accredit their joint educational provisions, including European degrees.
National legislation	Integrates the European degree as new type of qualification in National Qualifications Frameworks/law. Allows alliances to establish a legal status and to deliver joint educational provisions.




Figure 4. European Degree pathway.

² <https://esco.ec.europa.eu/en>.

The European Degree pathway is the most ambitious approach.

One aspect that requires clarification in this pathway is the design of the European degree diploma issued to students. The guidelines to design the European Degree diploma and the information to be included shall be harmonized at European level. It is important to use a European Degree logo (brand) shall be defined at European level. Guidelines for designing the European Degree diploma and the necessary information to be included should be harmonized at the European level. It is crucial to establish a European Degree logo (brand) defined at the European level.

As a starting point, from JEDI, we propose that the diploma should resemble the diploma delivered in the joint European Degree pathway. This entails a diploma featuring the names and logos of participating Higher Education Institutions (HEIs), with the addition of the logo of the European alliance where applicable, as well as the logo (brand) of the European degree.

Having a common European Degree logo defined at European level will contribute to make the degree differential, enhance its visibility and more knowledgeable than other joint degrees or national degrees.

However, one major drawback of the European Degree approach is the reluctance of student to enrol in a degree issued by a European Alliance. While recognized at European level, student deeply appreciate a degree emitted by a widely known, prestigious universities that are recognized by employers and stakeholder, rather than those issued by a European Alliance. The decision of enrolling in a university degree at different levels is strongly supported on the institution or institutions issuing the diploma. This holds particularly true for the domestic audience, as their trust is predominantly placed in national “brands.” However, the topic may be more receptive to audiences beyond the EU borders.

Considering above considerations, from JEDI, we see the European Degree as an opportunity in the very long-term once European Alliance are fully recognized in society, established and with sustainable funding strategies. The milestones needed for the European degree will be:

- 1) The European alliances transformation into legal entities is clarified, including their roles, governance, accreditation to design and issue educational provision, funding strategy, etc.
- 2) The accreditation process of legal entities is clarified
- 3) The European Degree has been adopted in the national qualification frameworks
- 4) The harmonization of European universities and individual universities is accomplished.

4.3 Pathways towards a Joint European Degree: analysis on the application for regulated professions

According to Directive 2005/36/EC, a regulated profession is a professional activity or group of professional activities, access to which, the pursuit of which, or one of the modes of pursuit of which is subject, directly or indirectly, by virtue of legislative, regulatory or administrative provisions to the possession of specific professional qualifications; in particular, the use of a professional title limited by legislative, regulatory or administrative provisions to holders of a given professional qualification shall constitute a mode of pursuit [1].

There are major bottlenecks that clutter the recognition of qualifications for regulated professions across Europe. Firstly, the list of regulated professions differs from one country to another. Moreover, in some countries the regulated profession is defined at regional level. According to the Regulated Professions Database [3], there are a total of 6671 regulated professions in Europe, where only 1942 has harmonized training requirements. A simple search on the database for “engineer” profession heterogeneous results per country: Spain 26, Germany 6 (with application to all regions or specific regions), Ireland 12 and Cyprus 9 professions. However, the results of the search include professions that do not require a university degree.

Table 4 shows the situation of regulated engineering professions is also quite diverse in European countries. Results in are dated from 2005 and are representative of the situation. According to [4], the regulated levels defined are:

- Total = all professional titles are protected, and Tasks reserved regulated in all disciplines
- Regulated = all professional titles are protected, and some Tasks reserved regulated in some disciplines
- Partially regulated = only some professional titles are protected, and some Tasks reserved regulated in some disciplines
- Not regulated = none above

Table 4. Overview of the level of regulation of the engineering profession in European countries [4].

Not regulated	Belgium, Finland, Netherlands, Norway, Sweden
Regulated	Austria, Bulgaria, Czech Republic, France, Lichtenstein, Lithuania, Luxembourg, Romania, Slovakia, Switzerland
Partially regulated	Estonia, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Malta, Portugal, Slovenia, United Kingdom
Totally regulated	Cyprus, Greece, Spain

Secondly, the recognition of graduates for regulated professions across Europe involves a variety of different administrative processes regulated by each national legislation. This situation also applies to engineering degrees qualifying for a regulated engineering profession.

It is also important to highlight that only in Europe there is a system of automatic recognition of professional qualifications for seven sectoral professions: nurses, midwives, doctors, dentists, pharmacists, architects, and veterinary surgeons [5].

For instance, in Spain engineering profession requires the homologation of university degrees obtained in other countries. The administrative process is as follows:

- Application to the Ministry of Universities
- Submission of the original diploma along with an official translation certificate
- Submission of the original academic certification in ECTS along with an official translation certificate

After thorough evaluation of this documentation, it is often necessary to supplement the original degree with additional courses to cover the professional competences not attained in the original university program. This admission and registration in a university that provides the necessary habilitation degree.

In France, there is no regulation for the engineering profession. However, its recognition relies on key entities such as the Commission des Titres d'Ingénieur (CTI) [6].

Other institutions are the Ingénieurs et Scientifiques de France (IESF) [6] and the Conférence des directeurs des écoles françaises d'ingénieurs (CDEFI). IESF is a non-profit association of French engineers and scientists, of which the CTI is a partner, notably for the annual survey of engineering graduates and for the visibility of the Journées nationales de l'ingénieur, the IESF's annual event. CDEFI is a non-profit association representing all the directors of public and private engineering schools and components of engineering schools accredited by the Commission des titres d'ingénieur (CTI) to award engineering degrees. Created by decree in 1976, the CDEFI's mission is to represent engineering schools and universities of technology in dealings with the French government, the European Union and international organisations.

The CTI plays a pivotal role in accrediting and evaluating engineering programs, ensuring adherence to educational standards and the delivery of the prestigious “Ingénieur Diplômé” title.

The accreditation process for an engineering education program in France is overseen by the Commission des Titres d'Ingénieur (CTI). This regulatory body plays a crucial role in evaluating and approving engineering programs offered by

institutions. The process typically involves a comprehensive assessment of the academic curriculum, faculty qualifications, facilities, and the overall quality of education provided by the engineering school. The CTI examines whether the program aligns with established educational standards, ensuring that it covers essential engineering principles and meets the evolving needs of the industry. The evaluation considers factors such as the depth of technical content, training components, and the school's ability to foster critical thinking and problem-solving skills among students. Furthermore, the CTI assesses the resources available to the program, including laboratories, libraries, and technological infrastructure. The aim is to guarantee that students have access to the necessary tools and environments to develop their engineering skills effectively. Once the evaluation is completed, the CTI may grant accreditation to the engineering program, indicating that it meets the defined criteria for quality and relevance. This accreditation is significant, as it allows the institution to confer the recognized title of "Ingénieur Diplômé" upon graduates, affirming that they have completed a program meeting national standards and are well-prepared for professional practice in the field of engineering.

Additional information can be found in [8] and [7].

IESF, representing kind of an equivalent of an Order of Engineers, contributes significantly to professional regulation by promoting ethical values and a code of conduct. The collaborative efforts of the CTI and IESF ensure a comprehensive regulatory framework for the engineering profession in France, emphasizing both academic excellence and adherence to ethical principles.

In Sweden, there is no regulations for engineering professions. There is however learning outcomes in the Swedish National Degree Ordinance for 3- and 5-year engineering degrees. These learning outcomes are influenced by engineering approaches such as CDIO and EUR-ACE. It's important to note that these guidelines are not mandatory, and some universities offer engineering programs leading to generic bachelor's and master's degrees without adhering strictly to these frameworks.

In Romania, there is a national body, National Centre for Recognition and Equivalence of Diplomas (CNRED), who recognizes documents of higher education studies obtained abroad by assessing and determining the level, main field of studies and/or specialization of the study certificate obtained abroad in relation to the Romanian education system. There is also an automatic recognition of diplomas obtained in a member state of the European Union, the EEA and the Swiss Confederation who ensures access to continuing studies in Romania.

For access to the labour market, CNRED recognizes bachelor's, master's and doctorate level study documents obtained at universities in the EU and prestigious universities in other countries, without requiring the taking of



differential exams or other compensatory measures. This provision does not apply to diplomas that give access to the exercise of a regulated profession, in which case compliance with the minimum mandatory provisions established by European and national legislation is verified³.

An interesting Romanian case-study is that of the architecture profession, which by legislative manner, through the means of the *184/2001 National Law regarding the organization and conduct of the architecture profession*, regulates, with the help of the National Order of Architects (OAR), all activity within the architecture field, defining it as a cultural act of public interest, with urbanistic, economic, social, and ecological implications. Nevertheless, in Romania, all faculties of architecture, with the Technical University of Cluj-Napoca Faculty of Architecture and Urbanism included, offer graduates solely an architect diploma, not an architect-engineer one⁴.

From JEDI, we see Joint European Engineering Degrees as an opportunity to foster the recognition of engineering professions. The initial phase should take place at the political level: it will consist in the joint harmonization by a group of European countries (ideally, across all Europe) of a set of competences to recognize the qualifications of regulated engineering professions. This approach will contribute to leverage the interest and attraction of the engineering profession leading to further engineering innovation in Europe.

Based upon these agreed competences and the criteria set for European degree, a joint programme could hold designed as a Joint European Degree. The joint diploma would be automatically recognized across the European countries, thereby streamlining the mobility of engineers across Europe.

However, the implementation of a European Degree for regulated professions is more difficult as employers usually base their human resources selection based on the qualifications of universities, and the issuance of degrees from a European alliance will take more time to be maturely established.

³ Additional information on CNRED can be found in <https://cnred.edu.ro/en/higher-education-studies/>.

⁴ More information on the activity of the OAR can be found here <https://oar.archi/en/>.

5 Student-centered learning approaches applicable to engineering degrees

During the definition and subsequent implementation of the European Area of Higher Education (EHEA), the promotion of student-centered learning and assessment approaches and methods has been a constant leading to important transformations. Especially in the first decade of the XXIst Century, this desire to promote student-centered learning led to a revival and spread of project- and problem-based learning (PjBL and PBL, from here on PBL as acronym including both) methodologies through educational innovation actions and projects. These were quite common since the days of Maria Montessori and Jean Piaget in K-12 education, but not so often employed at the European engineering universities to vertebrate programmes of study, deliver content and promote a wider set of transversal and professional skills. An evident exception has been the classical culmination of engineering degrees with a final degree thesis, in which engineering students normally apply the knowledge acquired to a real-life scenario, through the development or reengineering of a product, process or systems. In this sense, engineering degrees have been always quite special, for including this final learning action linked to professional development and practice. This is the reason why in JEDI we support the extension of the criterium for the Co-evaluation and co-supervision of dissertations to EQF 6, 7 and 8.

Progressively, in parallel to the implementation of the EHEA, the benefits of PBL actions have been better understood by the educational community and in many ways reformulated to take benefit from them, not only as a final degree challenge, but to more systematically and gradually educate engineers oriented to complex problem solving in challenging times. At the same time, important limitations of traditional project-based learning have been discussed and various strategies have been implemented to correct them. Among classical limitations it is important to highlight that, in many universities, the classical PBL linked just to the development of a final degree thesis usually involved students focusing on engineering problems or tasks proposed by their mentors, but normally working alone. Hence, the opportunity to live through a real real-life professional experience was often lost and a wide set of transversal and professional skills were not adequately fostered, being the final degree theses just technical or technological aspects.

Indeed, more holistic approaches to project-based learning were needed, involving educational actions more related to creativity promotion, teamwork and communication skills, increased internationalization and diversity, compromise with sustainability, orientation to change and societal impact, among others. In this respect, it is important to highlight the model proposed by the “International CDIO Initiative” aimed at truly transformative PBL through “Conceive-Design-Implement-Operate” cycles leading to functional engineering products,



processes, or systems, which has been put into practice and refined by the more than one hundred universities partners of the initiative. In many ways, this approach dates back to the classical Bauhaus (“let’s train a new generation of architects and designers through their theoretical and practical involvement in the construction of the university campus and its facilities”) but expanded to all engineering areas.

However, implementing complete CDIO-PBL actions may be sometimes challenging, from the point of view of human and material resources, and perhaps too ambitious for some one-year joint degrees. Besides, European engineering programmes are too diverse to achieve a one-size-fits-all solution or universal PBL methodology. Furthermore, there should be enough options for delivering knowledge and technical content, but also for letting students live through interdisciplinary, multidisciplinary, and trans-sectoral experiences that support their active role in their education personalization, and for underpinning their understanding and commitment to European cultural values and heritage. In consequence, a diversity of student-centered methodologies, beyond classical PBL, should be applied.

These reflections align with the results from JEDI’s “educational colabs”. For example, results from the innovative education colab highlight the need for an engineering education in continuous evolution, capable of dynamically adapting to technological advances and societal needs. European programmes focusing on sustainability are also seen as directly connected to European values, as well as the need for an ethics-guided engineering education. In the current state of increased technological change pace, flexibility and more straightforward accreditation and mutual recognition schemes would lead to increased personalization of the engineering studies and to students more responsible of their unique learning path. This increased decision-making power of students in the definition of their personal career trail, professional life and lifelong learning strategy, is pedagogically noteworthy, and will arguably lead to more responsible and mature engineers.

Another fundamental asset of European education is its equity. Therefore, joint European engineering programmes should be established with concrete means and appropriate funding or sponsorship to be equitably accessible, on the basis of merit, not the privilege of a few.

As summarized in the colab reports, sustainability and ethics should be the yardstick of European programmes, and a key differential mark of European engineers, whose moral values should help transform society in a sustainable and caring manner, thus providing an exemplary trend for engineering educators and practitioners worldwide.

Educational innovation is hence required to incorporate all these necessary aspects in the training of European engineers. To this end, a summary of student-

centered methodologies, is provided in Table 1 below as innovative methods to vertebrate and deploy JEDI programmes. These include a wide set of variations of PBL actions, from the more holistic to the easier to implement, even with limited resources. Different formats allow for collaboration with research departments, companies or associations and may importantly facilitate the internationalization of engineering students and the promotion of European values. Different combinations of these kinds of experiences may also foster education and contribute to scaffolding mobility schemes, making these mobilities even more transformative from an educational point of view. Most of them can be performed onsite and online, which can contribute to educational equity.

Ideally, for a European joint degree, the more transformative PBL experiences, including the final degree theses, either from bachelor’s or master’s degrees, as well as the complete CDIO experiences should involve joint mentoring by professors from different institutions and countries. An interesting path to explore and promote is the twining among students from the different centers involved in these actions. For instance, PBL courses implemented in parallel in the different partner institutions could tackle similar problems with their respective teams and, at the end of the course and as part of the evaluation of outcomes, put together the results achieved. In the mid-/long-term the PBL experiences could gain in internationalization by working in teams with members from the different partner institutions operating as real-life multinationals for an arguably increased training of professional skills.

Step by step the topics for the PBL experiences and related projects could gain in multidisciplinary, with students from different engineering disciplines working together to solve a real engineering challenge, and in interdisciplinarity, searching for alliances with degrees beyond engineering and non-technical universities implementing innovative courses leading to new disciplines and radical ways of managing societal problems, linked to service learning.

Table 5. A diversity of educational student-centered experiences with possible implementation examples for the EU engineers of the future. Adapted and expanded from [20].

PBL student-centered experiences	Brief description	Possible implementation examples
Final degree theses	Holistic and highly integrative PBL experience, in which students, normally on their own and supported by a mentor, design de novo an engineering solution or optimise an existing product or system.	<ul style="list-style-type: none"> - Develop a lightweight structure. - Optimise a system’s eco-impacts. - Design a vehicle suspension. - Prototype an innovative drone.
R&D PBL	In-depth study of a specific problem, within an ongoing R&D project of a university department and supporting	<ul style="list-style-type: none"> - Design a biomedical MEMS. - Develop an AI-aided device/process.

	project's team. As in capstone projects, a paper based on results may be written as conclusion.	<ul style="list-style-type: none"> - Research an innovative material. - Explore biohybrid machines.
In-company PBL	Immersive industrial experience, through which students live a professional practice helping to solve a real problem or trying to optimise company's processes, products, or solutions.	<ul style="list-style-type: none"> - Enhance a production line. - Select subsystems for a new plant. - Help with a marketing strategy. - Reengineer an internal procedure.
CDIO-PBL	Highly integrative PBL experiences, in which students' groups live through the complete conceive-design-implement-operate cycle of innovative engineering products, processes or systems.	<ul style="list-style-type: none"> - Design & build a medical device. - Prototype a 3D printing machine. - Create a pump for remote regions. - One-week or "express-CDIO" actions.
Synthetic PBL	PBL experiences focused on reaching a solution proposal for an engineering problem. Typically, students detect a need, develop a concept, and reach a design of an engineering product, process, or system.	<ul style="list-style-type: none"> - Design a specified gearbox. - Define the layout of a factory. - Model an eco-house. - Define a product recycling strategy.
Analytical PBL	PBL experiences focused on the study of an existing engineering system, which is normally divided into subsystems and components for understanding and its functional principles and behaviour.	<ul style="list-style-type: none"> - Simulate a production chain. - Model a robotic arm kinematics. - Reverse engineer a solar panel. - Model a chemical bioreactor.
Descriptive PBL	PBL experiences, in which students, in some cases following a case study approach, describe a relevant need and existing solutions, documenting one of the possible solutions in detail.	<ul style="list-style-type: none"> - Select and describe a machine. - Document a factory's subsystems. - List down the materials of a satellite.
Service-learning experiences	Formative experiences with a clear social purpose, in which students are connected to a real societal problem and asked to provide an engineering-related solution after interaction with key stakeholders.	<ul style="list-style-type: none"> - Design campus recycling strategy. - Organise a social fundraising fair. - Conceive a purposeful network. - Build a fablab for a LMI setting.
International competitions	Like the local competitions, but international and normally involving more challenging problems and requiring the delivery of a final product prototype.	<ul style="list-style-type: none"> - Formula SAE/Student. - Solar Decathlon. - Robot design competitions.
Local competitions	Focused design competitions, usually for first-year students and with a socialization purpose, together with the formative objective, in which teams provide engineering solutions to open-ended questions.	<ul style="list-style-type: none"> - Creativity weeks / challenges. - App design competitions. - Applied engineering hackathons. - "Express CDIO" courses. - Design a medical device in one week.

Beyond PBL and related methodologies, other activities involving different types of participants and environments have also interesting educational implications for the European engineers of the future. Collaboration with different student associations, both preparing educational activities for incoming students or participating in activities as outgoing students, establishing mentoring actions between alumni and students, taking part in a wide variety of cultural and linguistic activities, organizing and contributing to science-technology-society debates, including ethical debates about emergent technologies, visiting real work environments, production lines, factories and companies in general, attending to exhibitions on the crossroads of technology and art, among many others, are valuable and should find a place in the programmes. In many ways they contribute to the interpersonal and communicative leadership skills, traditionally called soft skills, but now often referred to as “power skills”. Some of them, clearly aligned with JEDI’s concept for joint programmes and with the desire for engineering education, are listed in Table 2.

Table 6. Student-centered actions for promoting power skills, as a complement to the more technical and professionally oriented PBL actions.

Complementary student-centered experiences	Brief description	Possible implementation examples
Educational actions organised by students’ associations	Some of the most formative actions at universities are performed by students themselves according to their desires and catalysed through students’ associations.	<ul style="list-style-type: none"> - Organisation of scientific/cultural activities for incoming students. - Participation in students’ associations activities.
Educational actions linked to the third sector	Voluntary collaborations with the third sector, involving application of engineering, contribute to equity and align with the European value of distributed justice. They clearly connect with service-learning.	<ul style="list-style-type: none"> - Mentoring high school students with special needs. - Supporting local business (i.e. with the incorporation of ICT). - Collaborating with “engineers without borders” and engineering charities.
Industry-related complementary educational actions	An increased relationship between academia and industry provides students with high-value educational possibilities and helps them to plan their career.	<ul style="list-style-type: none"> - Mentoring programme with alumni as industrial mentors. - Internships in companies, cycles of visits to different industries.
Ethics-centered educational activities	Ethics-guided engineering education can be fostered, not only by concrete courses on ethics, but through hands-on activities, dedicated workshops and fruitful debates.	<ul style="list-style-type: none"> - Cycles of conferences on the ethics of emergent technologies (i.e. AI). - Workshop for understanding the application of beneficence, non-maleficence, respect for autonomy and justice to technological cases.

<p>European culture and heritage educational activities</p>	<p>Highlighted throughout JEDI's debates, European engineers stand out for their multi-cultural and multi-lingual background, for assuming diversity as a treasure, which in turn leads to respect, as a basic outcome for a successful professional practice and joyful life.</p>	<ul style="list-style-type: none"> - Seminars, film cycles, literary gatherings around European culture and heritage and the role of engineering in relation to them. - Establishment of an EU engineering passport with a set of badges gained through cultural and linguistic activities.
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Concluding, European joint degrees demand flexible schemes and wide sets of options for students to harmonize their studies. Holistic student-centered project-based learning actions linked to demanding challenges of the societies of the future, demanding multidisciplinary and interdisciplinary approaches, can contribute to students' technical and professional training and support the harmonization of degrees, simplifying accreditation schemes. At the same time, through several possible training actions, ethical, sustainability and cultural values should be fostered, to increase the compromise of the European engineers of the future with a transformative engineering based on the principles of beneficence, non-maleficence, equity and justice. Although different schemes may be possible, according to discussions maintained during JEDI, truly European engineers should at least live through one holistic project-based learning experience with an interdisciplinary or multidisciplinary component, take part in at least one relevant action and at least one interaction with industry or the third section, and complement the training with ethical and cultural training, either by means of dedicated courses or through hands-on formative actions.

6 JEDI approach to the Joint European Degree and European Degree

6.1 The academic curriculum of Joint European Degrees and European Degrees

Looking for a pragmatic and operational, it seems necessary to sketch how the academic curriculum of Joint European Degrees and European Degrees would be designed and organized.

6.1.1 Design of the academic curriculum: learning outcomes and European criteria

Based on the set of European criteria focused on academic and mobility aspects, a possible implementation of the curriculum for joint degrees in engineering, science, and technology (EQF 6 and 7) is shown in Figure 5.

The design of the joint programme that serves as basis for the Joint European Degree or the European Degree relies on three major dimensions: 1) the learning outcomes of the joint programme, agreed upon between the involved HEIs, 2) the fulfilment of the European Degree criteria and 3) the inputs and requirements from Quality Assurance and accreditation.

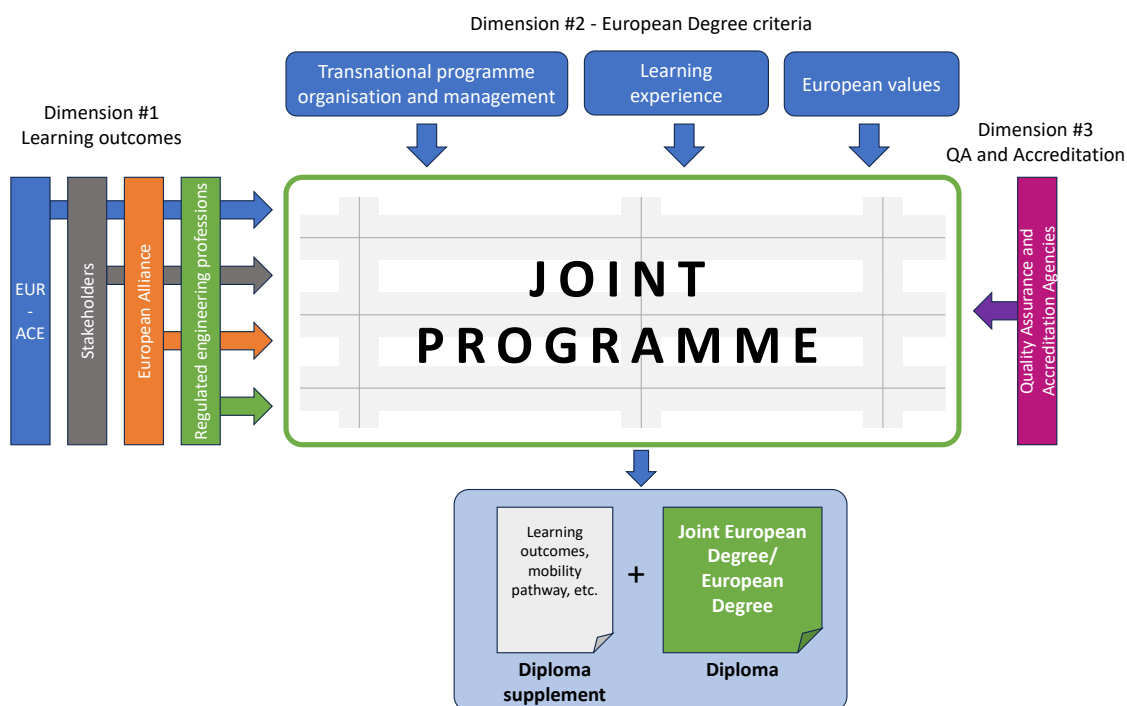


Figure 5. The design framework of the Joint Programme supporting the Joint European Degree and the European Degree pathways.

Learning outcomes (first dimension) of the joint degree may come from different sources:

- EUR-ACE programme outcomes: Programme outcomes may be defined as statements defining the knowledge, skills, and attitudes that students must have acquired by the time they graduate. EUR-ACE is fully accepted and recognized in engineering degrees and may serve as a reference to define learning outcomes. It is also important to mention that the EUR-ACE accreditation framework is valid for all branches of engineering and all profiles of study. Also, they distinguish between First and Second Cycle programmes, as defined in the European Qualification Frameworks and are applicable also to “integrated programmes”. The EUR-ACE Framework Standards distinguish between First Cycle and Second Cycle degrees and specify 21 Programme Outcomes for First Cycle degrees and 23 for Second Cycle degrees, grouped under the following six headings:
 - 1. Knowledge and Understanding
 - 2. Engineering Analysis
 - 3. Engineering Design
 - 4. Investigations
 - 5. Engineering Practice
 - 6. Transferable (personal) Skills
- Learning outcomes defined in the framework of a European Alliance. This would be the case of EELISA alliance, where the European Engineer Profile has been elaborated. This profile can be described through four general pillars [24]:
 - High level of scientific, theoretical and digital skills
 - Addressing sustainability
 - Interculturalism: an engineer embracing the European project
 - Business and communication skills and critical thinking: practical and applied knowledge

EUt+ has also its Reference Guide, approved by the Rectors Board, which establishes the framework to support the definition of the EUt+ Bachelor’s and Masters’s degrees in Engineering [21].

Within the ENHANCE framework, learning outcomes are tailored through initiatives like Sustainability, Entrepreneurship, and Innovation (SEI), European Education Pathways (EEP), and Future Skills for Engineers and Scientists [22][23]. The SEI approach aims to integrate SEI learning outcomes into the wider ecosystem, enhancing crucial competencies. The EEP initiative focuses on seamless mobility and customizable curricula, working towards a comprehensive ENHANCE European Degree Label incorporating diverse competencies, however not relying on joint programmes. Future Skills aims to equip learners with essential skills for societal challenges and the future labor market, through innovative

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teaching methods and educational formats. While ENHANCE does not prescribe a single set of learning outcomes for all degrees, it emphasizes a collaborative and inclusive approach to integrating European standards and professional competencies across its educational initiatives.

- For regulated engineering professions: to define a joint degree for a regulated engineering profession (e.g. civil engineer, industrial engineer, telecom engineer), a minimum set of learning outcomes should be agreed at European level to be incorporated as learning outcomes of the joint programme.
- Stakeholders: employers and other institutions such as alumni, regulators and society can play a major role in the definition of learning outcomes. According to European criteria, labour market requirements shall be taken into consideration to include intersectoral components and diverse activities aiming at providing transversal skills. They also are relevant when defining internships for EQF 6 and 7, but also to provide spots in their facilities for industrial PhD joint programmes (EQF 8).

Depending on the scope of the degree, the learning outcomes in the curriculum could come from a single origin or maybe a combination of learning outcomes. As an example, many engineering degrees are compliant with EUR-ACE programme outcomes and the competences required by national legislation for regulated professions.

The second dimension must respond to the European Joint Degree criteria agreed at European level (section 4.1).

The third dimension responds to requirements imposed by the Quality Assurance system and the accreditation bodies. Quality assurance arrangements are one of the European criteria. An input of the joint programme design coming from QA, goals of the curriculum shall be defined in a clear, measurable and achievable way, in order to ensure the monitoring of acquisition of learning outcomes properly through evidence. Another significant intervention in the joint programme design is the definition and implementation of joint policies.

6.1.2 Design of the academic curriculum: organization and mobility

The curriculum shall be divided into semesters. The agreed learning outcomes of the joint programme are distributed across each semester, as described and identified in the consortium agreement.

The academic organization of the joint programme with learning outcomes split into semesters allows the inherent implementation of a flexible and embedded student mobility. A student will realize a minimum of 60 ECTS at EQF 6 level and 30 ECTS at EQF 7 level in a different partner from his or her home institution. No credit recognition is required as this is included in the joint programme design.

Each partner institution will guarantee the acquisition of learning outcomes by students in the semester while deciding the most appropriate student-centered approaches.

The joint programme may foresee different specializations based on the preference of the students and their language skills and wishes.

Beyond the inherent multilingualism by involving two different EU countries with different languages, students would experience diverse student-centered learning approaches particular of the involved HEIs.

Option 1 – All the partners offer the full joint programme on their premises. More flexibility for students to decide his or her academic pathway along the joint programme, according to the agreed quotas in the consortium agreement.

Option 2 – Each partner institution offers a limited number of semesters. This will limit the mobility schemes, although possibly students will have to follow similar tracks.

These options illustrate two distinct typologies, it being understood that depending on the discipline, the institutional context, the pedagogical processes and the student audience, gradations are most likely conceivable.

For example, programs with a more continuing education vocation (certificates, executive-type diplomas) may have relatively diverse teaching time patterns.

Figure 6 shows an implementation of the joint program under the hypothesis that all the involved HEIs offers the full joint programme. The figure represents two of the possible pathways for the student to reach the joint degree diploma. The two pathways in the figure represent students with different mobility ambitions. “Blue” pathway represents a student whose home institution is HEI 1, that completes one year at each HEI. In this case, he or she starts in HEI 1 (60 ECTS), continues in HEI 2 for the second year (60 ECTS), and HEI 3 for the final year (60 ECTS).

“Green” pathway represents a student that follows in his home institution (HEI 3) the first two years, and the final year is continued in another HEI of the joint programme (in the figure, HEI 2). This “green” pathway would be representative of two years with basic and general courses, while the final year would be selected by the student according to his or her personal interest in terms of specialization and possibly language proficiency. Also, alternatives to physical mobility for students unable to travel could be designed in the “green” pathway for the final year.

Whatever the pathway the student follows in the joint programme, he or she will receive two documents:

- Joint European Degree or European Degree Diploma: document jointly issued by the HEIs or by the European alliance, respectively, fulfilling the requirements and format defined at European level.
- Diploma supplement: particular to every student, and gathering all the information regarding learning outcomes, mobility pathways, internships and all the information agreed by the involved HEIs in the consortium agreement.

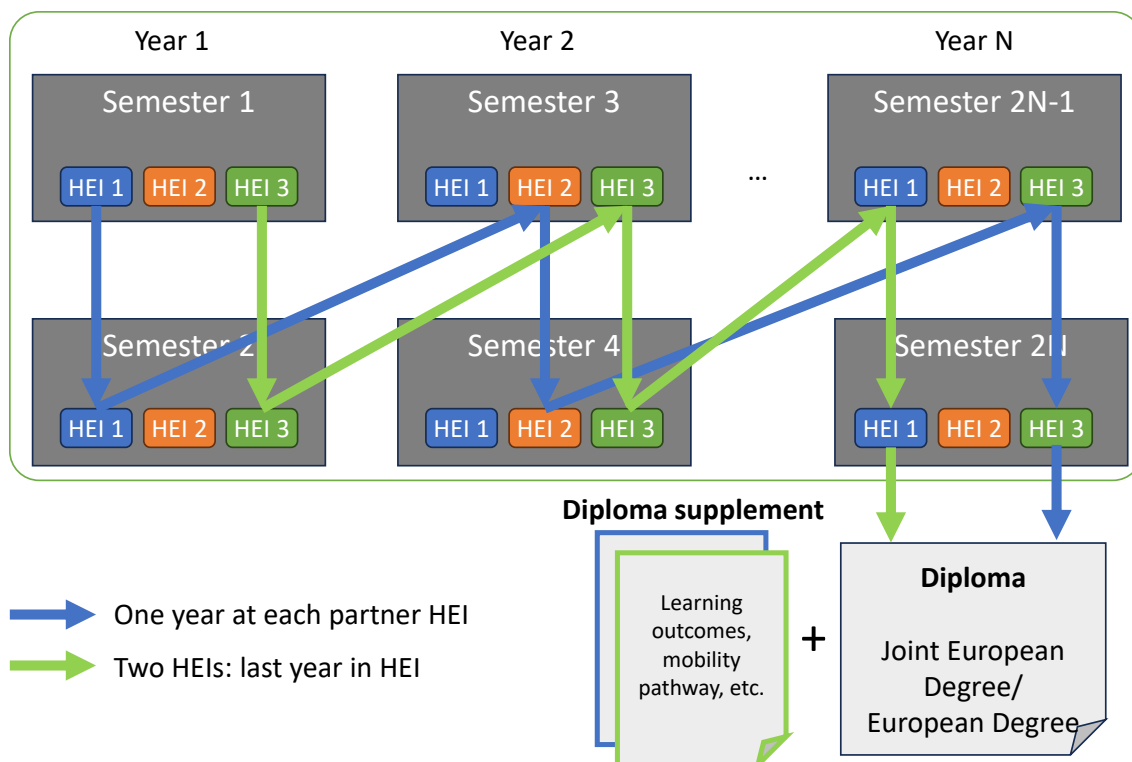


Figure 6. Joint program with 3 HEIs partners: all HEIs offers the full joint program.

Figure 7 shows an implementation of the joint programme where each HEI offers a set of learning outcomes. In this case, the pathway requires the student to stay in a different HEI partner every year (i.e. 60 ECTS per HEI), and thus the design of alternatives for students unable to travel would require thoughtful policies. Compared to the previous design, this approach is less flexible and offers a lower individualization of the curricula.

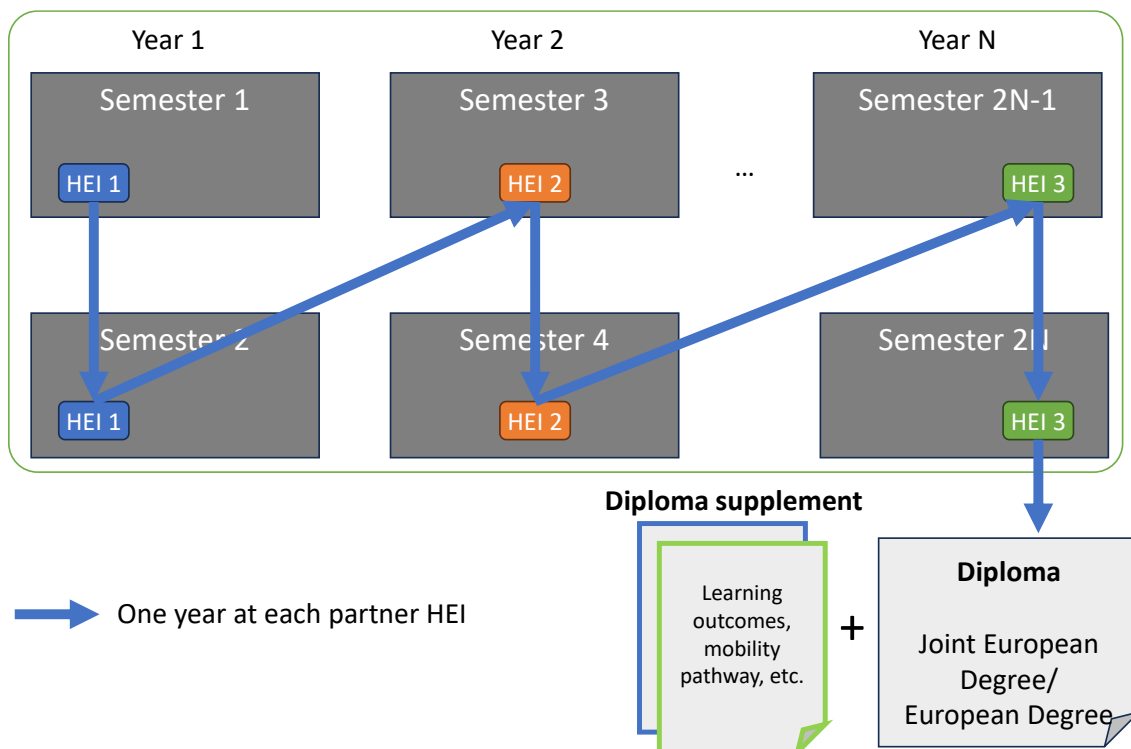


Figure 7. Joint program with 3 HEIs partners: each HEIs offers a set of learning outcomes.

Figure 8 represents a possible academic design for a 90 ECTS Joint Master programme considering three semesters: General, Specialization and a third semester combining Master thesis and internships. Under this approach, a Joint European Degree include a specialization semester, where the involved HEIs may offer different tracks according to their interests and areas where they are key areas. A student might decide to make each semester (shown in the green track in the figure) or dedicate only the third semester out from his or her home institution to complete the internship and Master thesis in a different HEI and country, being the thesis co-supervised by faculties from the two HEIs.

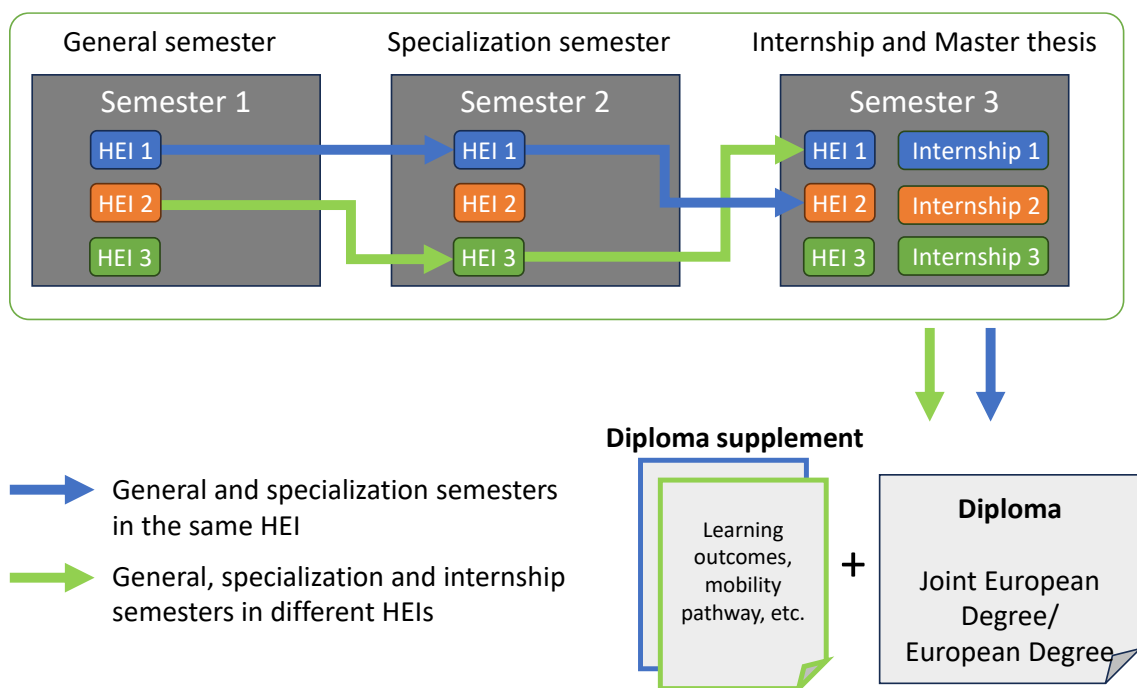


Figure 8. Joint Master program design with 3 HEIs partners.

In any of the design options, the consortium agreement shall detail the structure and content of the curriculum that should enable the students to achieve the intended learning outcomes [25].

From JEDI, we support implementations following the strategy of Figure 6 where maybe not all learning outcomes are offered by all the HEIs, but that will allow intrinsic flexibility to the students to design a personalized pathway along the joint programme.

6.1.3 Diploma, diploma supplement and brand

In terms of the diploma design and diplomas and certificates delivered to the students, two documents shall be produced.

- Diploma supplement – A diploma supplement certificate issued to the students including the learning outcomes attained throughout the joint programme, learning experience approaches, internships, languages to which the student has been exposed to, institutions where the student has realized the mobility, European Alliance, etc. The information in the diploma supplement shall be detailed in the joint programme agreement.
- Joint European Degree or European Degree diploma – Single document either electronic or hard-copy with the brand (logo) of the Joint European Degree or European Degree, and the logos of all the HEIs involved in the joint programme. In case of the European Degree, the logo of the

European Alliance or the consortium issuing the joint degree shall be included in the diploma. Depending on the final design of the diploma, it might include the academic pathway of the student.

In JEDI, we consider it necessary to issue an electronic copy of both the diploma supplement and diploma, following an approach like some features of microcredentials as defined by the European Union [26]: those documents shall be portable and may be stored and shared easily by the diploma holder. Alignment with European Approaches shall contribute to the recognition across the European Union.

6.2 Notes for the Standards for Quality Assurance of Joint Programmes leading to Joint European Degrees or European Degrees in the EHEA

One of the criteria of the European degrees regarding Quality Assurance arrangements is: “The joint programme is evaluated using the standards of European approach for quality assurance of joint programmes (EA).” This affects a proper definition of the joint programme in the consortium agreement.

In this section, we analyse how the Quality Assurance for Joint Programmes should be completed when approaching these new Joint European Degrees or European Degrees, considering the focus of JEDI in engineering, science and technology degrees.

1. Eligibility

1.1 Status

The institutions that offer a joint programme should be recognised as higher education institutions by the relevant authorities of their countries. Their respective national legal frameworks should enable them to participate in the joint programme and, if applicable, to award a joint degree. The institutions awarding the degree(s) should ensure that the degree(s) belong to the higher education degree systems of the countries in which they are based.

Aspects to be considered:

Joint European Degrees: Ensure the Joint European Degree is embedded in the national legislation of the countries where the HEI belong.

European Degrees: Ensure the Joint European Degree is embedded in the national legislation of the countries where the HEI belong and the legal status of University alliances is included, along with the certification of authorization for delivering European degrees.

1.2 Joint design and delivery

The joint programme should be offered jointly, involving all cooperating institutions in the design and delivery of the programme.

Different approaches can be followed as presented in section 6.1.2, and they shall be clearly identified and defined in the joint programme design.

1.3 Cooperation Agreement

The terms and conditions of the joint programme should be laid down in a cooperation agreement. The agreement should in particular cover the following issues:

- *Denomination of the degree(s) awarded in the programme*
- *Coordination and responsibilities of the partners involved regarding management and financial organisation (including funding, sharing of costs and income etc.)*
- *Admission and selection procedures for students*
- *Mobility of students and teachers*
- *Examination regulations, student assessment methods, recognition of credits and degree awarding procedures in the consortium*

Joint European Degrees: The consortium agreement shall include information on all the European Criteria. No recognition of credits shall be required as per design the acquisition of learning outcomes in the joint programme have been agreed by the involved HEIs and are fully supported by the Quality Assurance system.

European Degrees: A similar document to a consortium agreement shall be prepared with the required information on European criteria. No recognition of credits shall be required as per design the acquisition of learning outcomes in the joint programme have been agreed by the involved HEIs and are fully supported by the Quality Assurance system.

In case different assessment frameworks are present in the national legislation of the involved HEIs, conversion tables shall be included in the agreement.

2. Learning Outcomes

2.1 Level [ESG 1.2]

The intended learning outcomes should align with the corresponding level in the Framework for Qualifications in the European Higher Education Area (FQ-EHEA), as well as the applicable national qualifications framework(s).

Joint European Degrees: According to the two-dimension design of the joint programme, a flexible section of learning outcomes aligned with the scope of the programme can be selected. Learning outcomes for regulated professions are also applicable if agreed at European level or by a group of countries across Europe to ensure recognition of the professional qualifications.

European Degrees: According to the two-dimension design of the joint programme, a flexible section of learning outcomes aligned with the scope of the programme can be selected. Learning outcomes for regulated professions are also applicable if agreed at European level or by a group of countries across Europe to ensure recognition of the professional qualifications.

2.2 Disciplinary field

The intended learning outcomes should comprise knowledge, skills, and competencies in the respective disciplinary field(s).

Joint European Degrees: Although no recognition is required within the joint programme, for students willing to pursue registration in another degree, the disciplinary field of the joint programme could be required to support and facilitate the recognition process.

European Degrees: Although no recognition is required within the joint programme, for students willing to register in another degree, the disciplinary field of the joint programme could be required to support and facilitate the recognition process.

2.3 Achievement [ESG 1.2]

The programme should be able to demonstrate that the intended learning outcomes are achieved.

Joint European Degrees: Intended learning outcomes should be formulated in such a manner that they can be assessed in a student-centred manner. Their focus should be on what students are expected to be able to demonstrate upon completion of a module or programme.

European Degrees: Intended learning outcomes should be formulated in such a manner that they can be assessed in a student-centred manner. Their focus should be on what students are expected to be able to demonstrate upon completion of a module or programme.

2.4 Regulated Professions

If relevant for the specific joint programme, the minimum agreed training conditions specified in the European Union Directive 2005/36/EC, or relevant common trainings frameworks established under the Directive, should be taken into account.

<p>Joint European Degrees: Intended learning outcomes related to regulated professions shall be formulated to harmonize with European Directives and applicable national regulations. Moreover, impact on the Quality Assurance and accreditation shall be considered (see considerations and proposed approach section 7).</p>
<p>European Degrees: Intended learning outcomes related to regulated professions shall be formulated to harmonize with European Directives and applicable national regulations. Moreover, impact on the Quality Assurance and accreditation shall be considered (see considerations and proposed approach section 7).</p>

3. Study Programme [ESG 1.2]

3.1 Curriculum

The structure and content of the curriculum should be fit to enable the students to achieve the intended learning outcomes.

<p>Joint European Degrees: The set of learning outcomes can be divided into semester to allow students make their mobilities in different HEIs. The curriculum of the joint programme shall offer diversity of academic pathways that allow the student to personalize his or her curriculum while achieving the intended learning outcomes. At least, the intended learning outcomes and mobility pathways shall be included in the diploma supplement of the joint programme</p>
<p>European Degrees: The set of learning outcomes can be divided into semester to allow students make their mobilities in different HEIs. The curriculum of the joint programme shall offer diversity of academic pathways that allow the student to personalize his or her curriculum while achieving the intended learning outcomes. At least, the intended learning outcomes and mobility pathways shall be included in the diploma supplement of the joint programme</p>

3.2 Credits

The European Credit Transfer System (ECTS) should be applied properly, and the distribution of credits should be clear.

<p>Joint European Degrees: Already stated in the European degree criteria for EQF 6 and 7 levels.</p>
<p>European Degrees: Already stated in the European degree criteria for EQF 6 and 7 levels.</p>

3.3 Workload

A joint bachelor programme will typically amount to a total student workload of 180-240 ECTS-credits; a joint master programme will typically amount to 90-120



ECTS-credits and should not be less than 60 ECTS-credits at second cycle level (credit ranges according to the FQ-EHEA); for joint doctorates there is no credit range specified. The workload and the average time to complete the programme should be monitored.

Joint European Degrees: The workload definition shall be compatible with how Joint European Degrees are defined in the National Qualification Frameworks in terms of ECTS.
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European Degrees: The workload definition shall be compatible with how European Degrees are defined in the National Qualification Frameworks in terms of ECTS.
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4. Admission and Recognition [ESG 1.4]

4.1. Admission

The admission requirements and selection procedures should be appropriate in light of the programme's level and discipline.

Joint European Degrees: Admission and selection procedures shall be part of the joint policies defined in the joint programme, along with administrative matters or access to services in all participating HEIs.

European Degrees: Admission and selection procedures shall be part of the joint policies defined in the joint programme, along with administrative matters or access to services in all participating HEIs
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4.2. Recognition

Recognition of qualifications and of periods of studies (including recognition of prior learning) should be applied in line with the Lisbon Recognition Convention and subsidiary documents.

Joint European Degrees: No recognition of qualifications and periods of studies shall be required within the activities of the joint programme. Recognition of prior learning shall be agreed at consortium agreement level and applicable in any involved HEI.

European Degrees: No recognition of qualifications and periods of studies shall be required within the activities of the joint programme. Recognition of prior learning shall be agreed at consortium agreement level and applicable in any involved HEI.

5. Learning, Teaching and Assessment [ESG 1.3]

5.1 Learning and teaching

The programme should be designed to correspond with the intended learning outcomes, and the learning and teaching approaches applied should be

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adequate to achieve those. The diversity of students and their needs should be respected and attended to, especially in view of potential different cultural backgrounds of the students.

Joint European Degrees: It is important to design the joint programme with a focus on student-centered learning and assessment approaches. Also, a diversity of methodologies to ensure the acquisition of learning outcomes and the strengths of each HEI involved shall be promoted in the joint programme.

European Degrees: It is important to design the joint programme with a student-centered learning and assessment approaches. Furthermore, a diversity of methodologies to ensure the acquisition of learning outcomes and the strengths of each HEI involved shall be promoted in the joint programme.

6.2 Assessment of students

The examination regulations and the assessment of the achieved learning outcomes should correspond with the intended learning outcomes. They should be applied consistently among partner institutions.

Joint European Degrees: Assessment of learning outcomes shall be carried out compliant with the student-centred approach. Examination regulations shall be agreed by the involved HEIs and be gathered in the consortium agreement and made publicly available. Individual examination regulations shall be avoided to ensure uniformity in the joint programme.

European Degrees: Assessment of learning outcomes shall be carried out compliant with the student-centred approach. Examination regulations shall be agreed by the involved HEIs and be gathered in the consortium agreement and made publicly available. A common examination regulation for joint European degrees in the framework of the European Alliance shall be agreed to ensure homogeneity and avoid misunderstanding in the students in the joint programme.

6. Student Support [ESG 1.6]

The student support services should contribute to the achievement of the intended learning outcomes. They should take into account specific challenges of mobile students.

Joint European Degrees: European Degree label criteria already include a graduate monitoring system to track graduates in the joint programme. In addition, as part of the joint policies, the joint programme must guarantee student and staff support in order to comply with the first inclusiveness criterium.

European Degrees: European Degree label criteria already include a graduate monitoring system to track graduates in the joint programme. In addition, as

part of the joint policies, the joint programme must guarantee student and staff support in order to comply with the first inclusiveness criterium.

7. Resources [ESG 1.5 & 1.6]

7.1 Staff

The staff should be sufficient and adequate (qualifications, professional and international experience) to implement the study programme.

Joint European Degrees: Staff shall demonstrate a sufficient language level if they are involved in activities within joint programme which are not held in his or her mother language.

European Degrees: Staff shall demonstrate a sufficient language level if they are involved in activities within joint programme which are not held in his or her mother language.

7.2 Facilities

The facilities provided should be sufficient and adequate in view of the intended learning outcomes.

Joint European Degrees: No additional inputs required.

European Degrees: No additional inputs required.

8. Transparency and Documentation [ESG 1.8]

Relevant information about the programme like admission requirements and procedures, course catalogue, examination and assessment procedures etc. should be well documented and published by taking into account specific needs of mobile students.

Joint European Degrees: It is aligned European Degree criteria dealing with flexible and embedded student mobility, inclusiveness, joint arrangements for the joint programme and all related to joint policies.

European Degrees: It is aligned European Degree criteria dealing with flexible and embedded student mobility, inclusiveness, joint arrangements for the joint programme and all related to joint policies.

9. Quality Assurance [ESG 1.1 & part 1]

The cooperating institutions should apply joint internal quality assurance processes in accordance with part one of the ESG.

Joint European Degrees: The institution coordinating the Joint Programme may have a Quality Assurance system supporting the implementation of the joint programme.

European Degrees: The institution coordinating the Joint Programme may have a Quality Assurance system supporting the implementation of the joint programme.

7 Analysis current criteria needs of an application for a Joint Degree application in Engineering with the EUR-ACE label and the European Label and recommendations to streamline the accreditation process

In this section, we explore the current criteria needs of an application for a Joint Degree application in Engineering with the EUR-ACE label (which is the de facto standard in Europe to recognize the excellence of an engineering degree) and the European Label and recommend streamlining and reduce the overwhelming effort of the accreditation process.

7.1 Current context

As it can be seen in Figure 9, there several overlapping aspects and documents between the criteria which are imposed by different actors: national agencies, European Commission, ENAEE for EUR-ACE or the national legislation driving the rules for regulated professions and Joint Degrees.

From the figure it emerges a clear lack of harmonization among the different sets of criteria:

- Learning outcomes: the description of the joint program learning outcomes, designed and negotiated in the consortium agreement among the partners providing the diploma, would need to demonstrate compliance and traceability at least with respect to: the requests included in the national regulation of the country in which the application is submitted; the procedure defined by the corresponding accreditation agency; the frame for engineering defined by ENAEE in EUR-ACE; and, when applicable, the possible constrains or even exact descriptions which are mandatory in the case of regulated professions in multiple European countries in some fields of engineering.
- Student-centred learning: The application should demonstrate compliance as per the definition of the ESG and in the European Degree label criteria.
- Admission, recognition, mobility: they are part of ESG, European Degree label criteria, national regulations of joint degrees, and the specific procedures from the accreditation agencies.

	ESG	National regulation for Joint European Degrees	Agency requirements for Joint European Degrees	European Degree (label) criteria	Criteria linked to regulated profession	EUR-ACE criteria
Who	EHEA Ministerial Conference	Ministry for Higher Education	Accreditation Agency	EC	Ministry for Industry or equivalent	ENAAEE
Remarks	Only 1.3 appear in EU Degree (label) criteria	Defined in the specific national legislation	Defined in the specific national procedure			
Student-center learning	x (in 1 1.3)			x		
Learning outcomes		x	x		x	x (Program outcomes)
Admission, recognition	x (in 1 1.4)	x	x			
Mobility	x (in 1.6)	x	x	x		
Policy for QA	x (in 1 1.1)	x	x	x		

Figure 9. Analysis of the current criteria for needs of an application for a Joint Degree application in Engineering with the EUR-ACE label and the European Label.

7.2 Streamlining with the Joint European Degrees

In the case of regulated professions, the most challenging scenario is the one that forces the universities to define the learning outcomes exactly as defined by the corresponding authority, such as the ministry of that field. This is for instance the case of Spain, among others. In other countries as Hungary, the Hungarian Chamber of Engineers (HCE) conducts and certifies the qualification of professional engineers: an engineering diploma and engineering practice (MSc degree + minimum two years' practice or BSc degree + minimum five years practice) is needed for the membership of the HCE, and the authorisation to design or to be an expert has additional conditions, such as a required quantity of engineering subjects in the curriculum and a report on the candidate's training and experience [27].

The proposed approach simplifies the verification method to decide whether a graduated student has acquired the desired skills of one specific profession, but it implies a very strong limitation: the degrees must have that exact set of learning outcomes. The verification is done forcing a certain design of the degree. This challenge could be overcome if the validation of the matching between the program learning outcomes and the ones needed by the regulated profession would be done by analysing the description of the program and the proposal of

the institutions involved (a check for each specific field of study). Applying universities would add as an annex in the accreditation process a proposal for the mapping between the Program learning outcomes and the ones defined as mandatory for such regulated profession. ENAEE and Accreditation Agencies could coordinate the assessment of these proposals (the validity of the annex with the mapping) based on the principles of EUR-ACE.

A convenient way forward would be that Program learning outcomes of the European Degrees in Engineering would be described using EUR-ACE as a baseline, with the necessary derivations for the specific field of the program under consideration. For instance, the second Engineering design programme outcome from EUR-ACE could be particularized to any discipline as it is applicable to “*their engineering specialisation*” (Table 7). The opposite mapping approach going from national regulatory outcomes for regulated professions to EUR-ACE Pos would require a manual and rather unfeasible mapping.

Table 7. Example of modification of EUR-ACE Programme Outcomes to a given regulated engineering profession.

Original statement from EUR-ACE: “The learning process should enable Master Degree graduates to demonstrate ability to design using knowledge and understanding at the forefront of their engineering specialisation”.
Modified according to the proposed approach: “The learning process should enable Master Degree graduates to demonstrate ability to design using knowledge and understanding at the forefront of { <i>civil, industrial, mining, telecommunication, electrical ...</i> } engineering”.

On the other hand, a single unified application procedure for all Member States would allow the alliances having a single study programme accreditation system that could be used for all the joint degrees of the alliance and avoid the need to map against the criteria of the European Approach (requirement of the label criteria) and the specificities of national procedures depending on the country of application.

The compliance check with the ESG can also be waived from the list. In fact, only part 1 of the ESG is dedicated to the program, and within part 1, only 1.3 can be considered as specific of the program itself (the rest focus on the systems in place that universities must have). However, 1.3 (student-centered learning, teaching and assessment) is already included in the European Degree (label) criteria. Consequently, the request to map the program against the ESG could be waived for the member states in which the ESG are adopted. Table 8 represents a recommendation to streamline the applications shown in Table 8 with a simpler and more agile approach. The requirement would be to request Member States to update their regulations so the matching with the national regulation is kept as simple as possible.



Table 8. Recommendation to streamline the accreditation process of an application for a Joint Degree application in Engineering with the EUR-ACE label and the European Label.

	ESG	National regulation for Joint European Degrees	Agency requirements for Joint European Degrees	European Degree (label) criteria	Criteria linked to regulated profession	EUR-ACE criteria
Recommendation	Can be deleted.	As straightforward and simple as possible, not adding additional limitations to the European Approach.	Unified	To be applied.	Verified by the analysis of the learning outcomes described based on the EUR-ACE standards.	The matching with EUR-ACE would be direct as the learning outcomes could be derived directly from the EUR-ACE standards.
Suggested application		Only the specific sections for the coordinating country		European Degree label criteria	Only a mapping table as an annex	

8 Alignment of Joint European Degrees and European Degrees with the academic strategy of European Alliances

8.1 EELISA

The JEDI label could be strategically employed within the EELISA alliance to enhance the capabilities of academic teams interested in developing joint degrees or incorporating a European perspective into existing programs. It is designed to complement existing tools and frameworks, with criteria spanning organizational, academic, and European values.

These criteria harmonize with two other key reference systems within EELISA. Firstly, the EUR-ACE framework from the European Network for Accreditation of Engineering Education (ENAE) employs a learning outcomes approach, emphasizing the skills and knowledge students should acquire. Additionally, the EELISA European Engineer profile encapsulates the “EELISA philosophy” across four pillars: advanced scientific, theoretical, and digital skills; sustainability focus; intercultural competence; and proficiency in business, communication, and critical thinking.

These three approaches—the conceptual idealized profile, the outcomes-oriented EUR-ACE framework, and the European organizational criteria—operate synergistically, inspiring ongoing initiatives within the EELISA alliance.

The alliance’s initial joint degree, the Executive Master in Digital Twins for Infrastructures and Cities [28] is delivered primarily online, and several other joint degrees, ranging from bioengineering to quantum technologies at both Master’s and Ph.D. levels, are in development within the alliance’s “incubator”.

8.2 EUt+

Within the EUt+ alliance, the strategy we choose to create joint degrees is mainly to transform existing degrees by implementing a harmonized process that step by step becomes closer to a reference target. This target has been harmonized and is described by 2 reference documents: the Competences of EUt+ engineers and a reference guide.

The adopted reference guide describes an ambitious framework we try to implement and is described in terms of 12 features:

1. Embedded mobility / multi-campus model
2. Multilingualism / Multilinguisme
3. Self-customization of study track
4. Modularisation and flexibility
5. Student-centered learning

6. Challenge-based experiential learning
7. Innovative pedagogies
8. Academic rigour
9. Interdisciplinarity
10. Exposure / engagement with research
11. Civic engagement
12. Alignment with future labour market needs

These guidelines are inspired by ESG and covers questions related to discipline and skills as well as student experience with multilingualism and mobility questions for instance. The reference guide defines the profile of our degrees.

In practice for a given degree, the first step of this harmonized on process consists of defining common final learning outcomes for all partners involved. These final learning outcomes give the basement of the degree to define. Then partners work on opening student mobility based on common or equivalent basic outcomes of the proposed classes, automatic recognition of credits... and simultaneously on implementing the adopted guidelines.

Per se the JEDI Label could be used as an executive reference and a mean to value the joint degree which defines more specifically the requirements that a degree must satisfy to obtain a harmonize recognition for EU+ joint degrees.

By enforcing the importance of student experience in a broad sense, the label also helps to add momentum for transformation of national degrees toward harmonized joint degrees as far as national regulation allows it.

Within EU+ we have received very clear demands from students asking for a recognition of their enrolment in EU+ joint programs. A label helps to give recognition with a valuable certification that is supported by the European institution.

Last but not least, labelled students become implicit ambassadors of their labelled degree and pass on the EU+ name easing the recognition of EU+ students' degree at European scale.

8.3 ENHANCE

Within the ENHANCE framework, learning outcomes are tailored through initiatives like Sustainability, Entrepreneurship, and Innovation (SEI), European Education Pathways (EEP), and Future Skills for Engineers and Scientists. The SEI approach aims to integrate SEI learning outcomes into the wider ecosystem, enhancing crucial competencies. The EEP initiative focuses on seamless mobility and customizable curricula, working towards a comprehensive ENHANCE European Degree Label incorporating diverse competencies. Future Skills aims to equip learners with essential skills for societal challenges and the future labour market, through innovative teaching methods and educational formats. While

ENHANCE doesn't prescribe a single set of learning outcomes for all degrees, it emphasizes a collaborative and inclusive approach to integrating European standards and professional competencies across its educational initiatives.

9 General conclusions

In D3.2 we have gathered our conclusions regarding the JEDI label design and implementation. We base our conclusions based on internal discussions, the focus group with stakeholders external to JEDI, meetings with existing joint degrees owners and the discussions celebrated during the JEDI final event.

Considering the draft pathways proposed by the European Commission, the most ambitious and impactful approach for transforming engineering education in Europe is the implementation of Joint European Degrees. Although this approach requires the modification of national qualification framework, from the accreditation and recognition of professional qualifications across Europe, it is the preferred approach. Another relevant benefit of Joint European degrees fully recognized and being part of national qualification frameworks is the multilateral and straightforward recognition of the joint degree, thus avoiding today's case-by-case analysis. In the long term, once European alliances have a legal status with degree awarding capacity, the European degrees will be a reality.

The pathway leading to a European degree label might be a faster and short-term track but presents difficulties for the recognition across Europe. For existing joint degrees, a label approach could be an appealing option with modifications in the joint programme to comply with European criteria, with the straightforward advantage of involving a larger number of students. However, difficulties associated to the policies, diploma templates and accreditation requirements would still remain using the label path.

Another outstanding conclusion pertains to accreditation and quality assurance. Conversations with accreditation agencies suggest that there is no necessity for entirely new processes to be developed. It is feasible to get the accreditation of joint programmes utilizing procedures derived from those currently familiar to us. Establishing transparent and well-defined accreditation procedures can mitigate the internal and external obstacles typically encountered by new programs during their design and implementation phases.

JEDI has proposed modifications or recommendations to the European joint degree criteria in order to: extend the thesis co-supervision to EQF 6 and 7, adding the multidisciplinary to the interdisciplinary approach of the joint programme, modification of the denomination of Green transition to Environmental sustainability, and extending from 2 to 3 the number of involved Higher Education institutions. In addition, a new criterion to enhance the promotion and visibility of the joint programme. These modifications aim at enhancing the collaboration across European universities and at making Joint European Degrees recognized and accepted in Europe and regions beyond.

Some of the criteria are fully linked to the protagonist role that graduates of engineering, technology, and science-oriented degrees: Digital skills, Green



transition, student-centred learning with the active role of students, and interdisciplinarity.

Student-centred learning is a requirement for the transformation of engineering education. The various applicable methodologies, based on PBL, CBL or on the proposed innovative methods to vertebrate and deploy JEDI programmes, must be developed taking into account the particular features and resource availability of the joint programme. Additionally, engineering education should foster lifelong learning as a means of adapting the knowledge and skills of the graduate engineer to environments characterized by abrupt and rapid technological changes and societal demands.

Holistic student-centered project-based approaches are needed, involving educational actions more related to creativity promotion, teamwork and communication skills, increased internationalization, exposure to different cultures and diversity, compromise with sustainability, orientation to change and societal impact, among others.

In the current state of increased technological change pace, flexibility and more straightforward accreditation and mutual recognition schemes would lead to increased personalization of the engineering studies and to students more responsible of their unique learning path. This increased decision-making power of students in the definition of their personal career trail, professional life and lifelong learning strategy, is pedagogically noteworthy, and will arguably lead to more responsible and mature engineers.

Another fundamental asset of European education is equity, where joint European engineering programmes should be established with concrete means and appropriate funding or sponsorship to be equitably accessible, on the basis of merit, not the privilege of a few. Sustainability and ethics should as well be the yardstick of European joint programmes, and a key differential mark of European engineers, committed to transform society in a sustainable and caring manner.

European economy is grappling with technological dependency, primarily on non-European nations. This reliance poses significant risks to economic stability and national security. One potential solution to leverage European competitiveness lies in enhancing university education focused on technology and innovation through Joint European Degrees in engineering, science and technology-oriented degrees. By investing in joint education programmes, European universities and alliances can cultivate a skilled workforce capable of driving technological advancements domestically, thereby reducing dependency on external sources. Additionally, fostering interdisciplinary collaborations and encouraging entrepreneurship within academia can further bolster Europe's capacity to innovate and compete globally in the rapidly evolving technological landscape.

Joint European degrees is an opportunity to move forward to joint programmes for extending regulated professions at European level. An intensive analysis of the limitations that current accreditation processes has been carried out, leading to a proposal to verify the acquisition of the required skills. This verification is done forcing a certain design of the joint degree. This challenge could be overcome if the validation of the matching between the program learning outcomes and the ones needed by the regulated profession would be done by analysing the description of the program and the proposal of the institutions involved (a check for each specific field of study). Applying universities would add as an annex in the accreditation process a proposal for the mapping between the Program learning outcomes and the ones defined as mandatory for such regulated profession. ENAEE and Accreditation Agencies could coordinate the assessment of these proposals (the validity of the annex with the mapping) based on the principles of EUR-ACE.

A convenient way forward would be that Program learning outcomes of the European Degrees in Engineering would be described using EUR-ACE as a baseline, with the necessary derivations for the specific field of the program under consideration. For instance, the second Engineering design programme outcome from EUR-ACE could be particularized to any discipline as it is applicable to “their engineering specialisation”. The opposite mapping approach going from national regulatory outcomes for regulated professions to EUR-ACE Pos would require a manual and rather unfeasible mapping.

On the other hand, a single unified application procedure for all Member States willing to foster joint degrees for regulated professions would allow the European alliances having a single study programme accreditation system that could be used for all the joint degrees of the alliance and avoid the need to map against the criteria of the European Approach (requirement of the label criteria) and the specificities of national procedures depending on the country of application.

Further simplification would arise if Member States agreed to update their regulations so the matching with the national regulation is kept as simple as possible.

In order to leverage the development of Joint European Degrees, we have proposed a possible approach for the design of the academic curriculum. Three dimensions can be considered: 1), learning outcomes, 2) European criteria and 3) quality assurance and accreditation. Considering the dimension of learning outcomes, they will be defined as a flexible combination of inputs: EUR-ACE programme outcomes, regulated professions requirements, profiles of European alliances and stakeholders.

To ground the ideas and demonstrate how the implementation of the joint programs would look like, some scenarios of possible implementation have been included.

Regarding the needs identified for the Joint European Degrees, we highlight the need of a brand defined at European level. Similar to other European initiatives such as Erasmus+ that started as pilots and today are fully recognized and appreciated across Europe and beyond, the branding will aid to identify the European Joint Degree as a new and differential degree and will aid to the dissemination between students, universities and stakeholders.

In addition, the proactive and positive response of national governments to upgrade their national legislations accordingly to include Joint European Degrees in the national qualifications framework would pave the way towards transnational collaboration for designing joint programmes.

Taking all above into account, we are positive on the opportunities arising from the future landscape of Joint European degrees in engineering, science and technology-oriented degrees.



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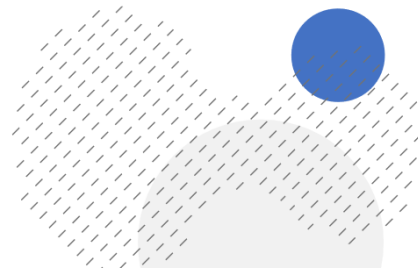
11 Annex 1 – Material used in the focus group



Discussion Context settings

- For a joint degree, can a label bring added value for students?

Is the label meant to be more even more exclusive than Joint Degrees?

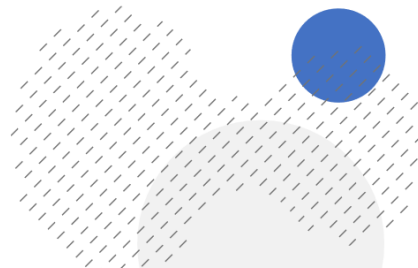


Discussion European Union criteria

- Are the criteria key elements for the correct implementation of the label?

Is their definition complete and clear enough?

When being applied, could the definitions cause unequal applications depending on the interpretations of the universities, agencies or administrations?



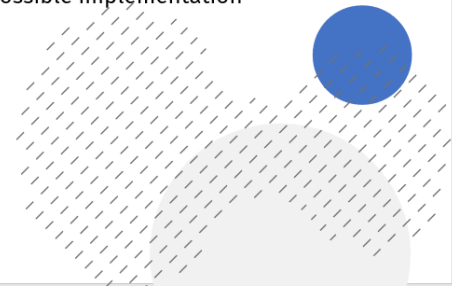


Discussion **European framework: innovation, transnational campus, digitalization**

- How should engineering education innovate in terms of classroom techniques and methodologies?

What teaching innovations would be necessary to facilitate the EDL, for example, for students from different universities to work together without physical mobility?

Is digitalization an area for improvement in the context of a possible implementation like the European Degree Label?



Discussion **Image, identity, and dissemination of the label**

- How critical is that is certificate is digital? Should it be a priority?

Does the label have more meaning as a driver of a possible common European framework?

Is the label a brand for possible transnational dissemination?

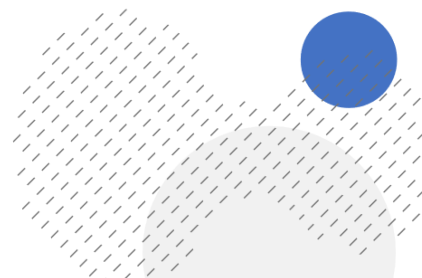


Discussion JEDI proposal

- What does the JEDI EU label bring compared to other labels (e.g., EUR-ACE, EUR-INF)?

What would be the most plausible way forward to provide EU labels linked to programmes based on your expertise?

What impact does it have on current accreditation structures and processes?

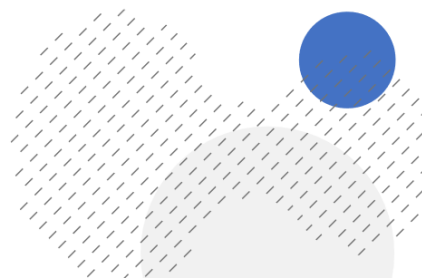


Discussion Additional questions

- Which impact would you like to have? Having <10% of your HEI degrees with a label? Between 10 and 50%, or more than 50%?

Would you say that getting the European label should be rather exclusive (for the elite of best students) or inclusive (with most students participating and being this representative of the HEI community)?

What do you find more feasible: designing the JD from scratch, or could an adaptation of current titles be made?

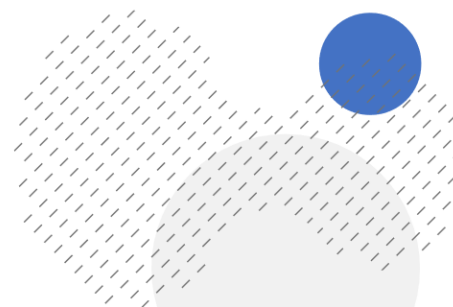




Discussion **Additional questions**

- What are the main barriers to the institutional implementation of the EDL? Difficulties in integrating students from other universities? Faculty resistance? Information and management systems? How is the participation of professors in programs with EDLs rewarded?

Is it attractive to non-European students?



12 Annex 2 – List of joint degrees participating in the meeting

Full official name of the Programme – acronym	Master in Global Challenges for Sustainability
European Alliance Joint Program	CHARM-EU
Level	Master
MSc, BSc, BE, etc.	MSc
Coordinator – Institution (country)	Trinity College Dublin (Ireland)
Coordinator Country	Ireland
List of partners (with their respective countries)	University of Barcelona (SP) Trinity College Dublin (IR), Utrecht University (NL) Eötvös Loránd University (HU) University of Montpellier (FR)
Number of partners	Spain; Ireland; Netherlands; Hungary; France
Number of partners	5
Years	2
ECTS	90
URL	https://www.charm-eu.eu/masters/globalchallenges
Owner email	charm-euoffice@ub.edu
Area of Knowledge / Study Fields	Sustainability Engineering
Type of JP	AJP
Quality Agency	Accredited in Spain, Ireland, the Netherlands, Hungary, and France
Delivered Degree type	Unique
Multiple or Joint Degree	Joint Degree
Regulated Profession	No
Fees	Dependent
Admission process	Unique
Student Mobility	Blended mobility
Student Mobility Duration	N/A
Internships recognition	No
Apprenticeships recognition	No
Seminars recognition	N/A
Learning method	Blended
Labels	Joint programme accreditation
Academic organisation	Semester
Summer/winter schools	No
Hackatons	No
Languages classes	No
SDG competencies	Yes
Digital Skills	No
Volunteering recognition	No

Full official name of the Programme – acronym	Erasmus Mundus European Joint Master ´s Degree in Electric Vehicle Propulsion and Control (E-PiCo)
European Alliance Joint Program	No
Level	Master
MSc, BSc, BE, etc.	MSc
Coordinator – Institution (country)	Centrale Nantes (FR)
Coordinator Country	France
List of partners (with their respective countries)	Centrale Nantes Universita Degli Studi dell´Aquila Christian-Albrechts-Universitat Zu Kiel National University of Science and Technology Politehnica Bucharest
Number of partners	France; Italy; Germany; Romania
Number of partners	4
Years	2
ECTS	120
URL	Master E pico (ec-nantes.fr)
Owner email	epico@ec-nantes.fr
Area of Knowledge / Study Fields	E-mobility
Type of JP	EMP
Quality Agency	
Delivered Degree type	Unique
Multiple or Joint Degree	Joint Degree
Regulated Profession	No
Fees	Dependent
Admission process	Unique
Student Mobility	Physical Mobility
Student Mobility Duration	24 months
Internships recognition	N/A
Apprenticeships recognition	N/A
Seminars recognition	N/A
Learning method	Blended
Labels	Joint programme accreditation
Academic organisation	Semester
Summer/winter schools	Yes
Hackatons	No
Languages classes	No
SDG competencies	No
Digital Skills	No
Volunteering recognition	No



Full official name of the Programme – acronym	Master Bio Marine Technology de l’Université européenne
European Alliance Joint Program	EUCONEXUS
Level	Master
MSc, BSc, BE, etc.	MSc
Coordinator – Institution (country)	Universidad Católica de Valencia San Vicente Mártir (SP)
Coordinator Country	Spain
List of partners (with their respective countries)	Agricultural University of Athens La Rochelle Université Universitatea Tehnica de Constructii Bucuresti Klaipėdos Universitetas Sveučiliste u Zadru
Number of partners	Greece;France;Romania;Lithuania;Croatia
Number of partners	5
Years	2
ECTS	120
URL	https://www.eu-conexus.eu/en/marine-biotechnology/
Owner email	Mbacademic.coordinator@eu-conexus.eu
Area of Knowledge / Study Fields	Marine Biotechnology
Type of JP	EMP
Quality Agency	HCERES
Delivered Degree type	Unique
Multiple or Joint Degree	Joint Degree
Regulated Profession	No
Fees	Independent
Admission process	Unique
Student Mobility	Physical mobility
Student Mobility Duration	24 months
Internships recognition	N/A
Apprenticeships recognition	N/A
Seminars recognition	N/A
Learning method	Blended
Labels	Joint programme accreditation via European Approach
Academic organisation	Semester
Summer/winter schools	No
Hackatons	No
Languages classes	No
SDG competencies	No
Digital Skills	No
Volunteering recognition	No



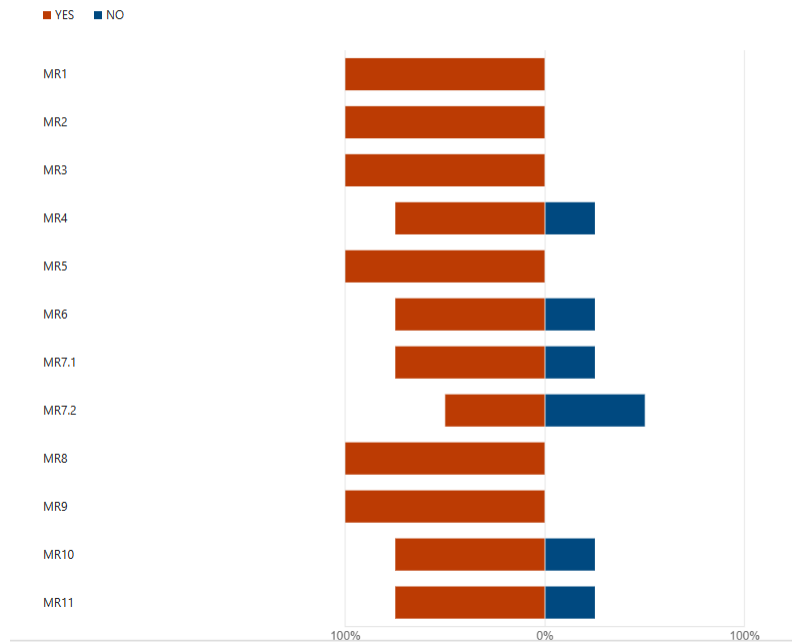
Full official name of the Programme – acronym	Erasmus Mundus in Sustainable Transportation and Electrical Power Systems
European Alliance Joint Program	No
Level	Master
MSc, BSc, BE, etc.	MSc
Coordinator – Institution (country)	Universidad de Oviedo (Spain)
Coordinator Country	Spain
List of partners (with their respective countries)	University of Nottingham (UK), Politécnico de Coimbra (Portugal), Sapienza Università di Roma (Italy)
Number of partners	United Kingdom;Portugal;Italy
Number of partners	3
Years	2
ECTS	120
URL	https://www.emjmdsteps.eu/inicio
Owner email	garciajorge@uniovi.es
Area of Knowledge / Study Fields	Electrical Transportation, Power Systems
Type of JP	EMP
Quality Agency	
Delivered Degree type	Unique
Multiple or Joint Degree	Joint Degree
Regulated Profession	No
Fees	Dependent
Admission process	Differ from the partners
Student Mobility	Physical mobility
Student Mobility Duration	6 months
Internships recognition	Yes
Apprenticeships recognition	N/A
Seminars recognition	Yes
Learning method	Face-to-Face
Labels	Erasmus Mundus master degree
Academic organisation	Semester
Summer/winter schools	Yes – Summer/Winter Schools
Hackatons	No
Languages classes	Yes
SDG competencies	No
Digital Skills	Yes
Volunteering recognition	No



13 Annex 3 – Results of the survey to Joint degrees owners

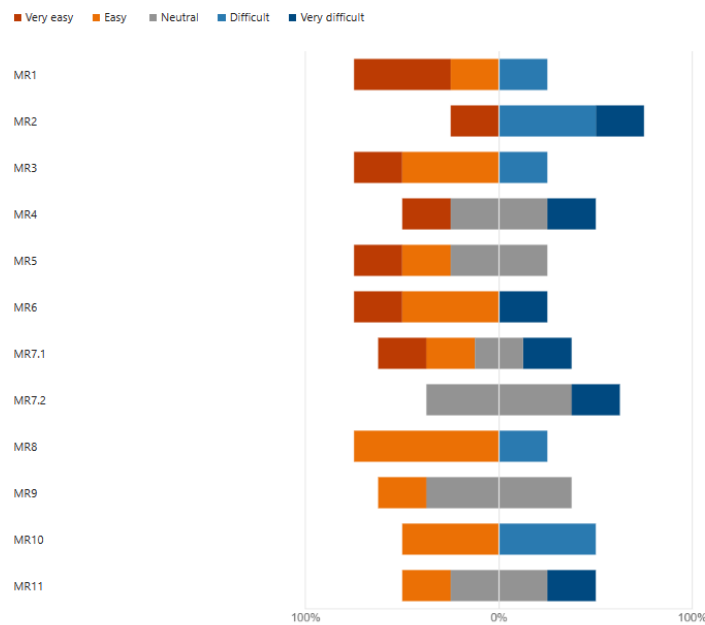
4. Is the joint degree meeting these minimum requirements? Refer to the criteria defined in the Excel sheet to complete this table.

[Más detalles](#)



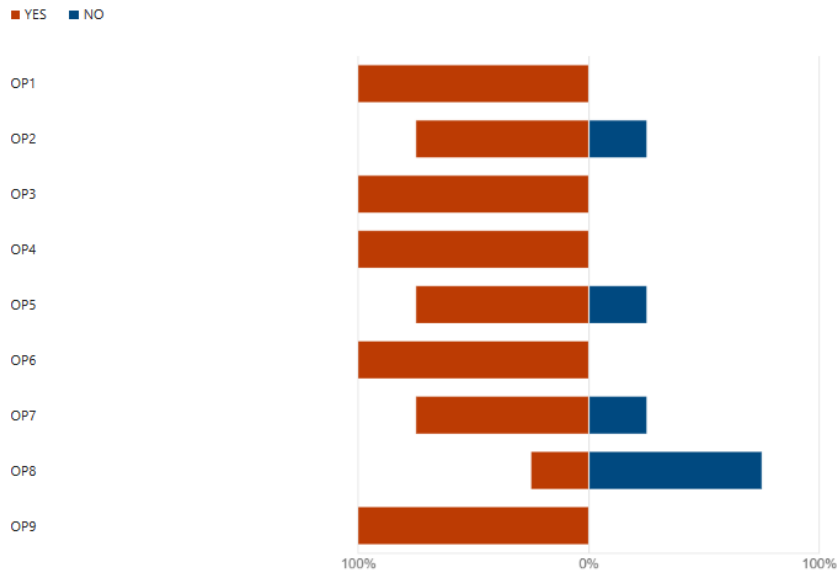
5. Rate the level of difficulty in implementing minimum requirements in the joint degree. Refer to the criteria defined in the Excel sheet to complete this table.

[Más detalles](#)



6. Is the joint degree meeting these optional criteria? Refer to the criteria defined in the Excel sheet to complete this table.

[Más detalles](#)



7. Rate the level of difficulty in implementing optional criteria in the joint degree. Refer to the criteria defined in the Excel sheet to complete this table.

[Más detalles](#)

