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**MSc's Rules and Requirements and Draft Guideline**

**D2.2**

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## Introduction

*“A tailor-made sustainability strategy needs to be developed and included in the original design of each Master programme. This strategy needs to be elaborated jointly by all consortium members ....”*

Sustainability of Erasmus Mundus Master Courses, Best practice guide based on survey results and analysis (2017)

The successful implementation of Joint Master Degrees continues to be a major challenge in Europe, where some key factors are directly related with the design and management. Several good practices and tools have been piloted and implemented in particular through the Erasmus Mundus programme, providing useful results for the development of future initiatives.

Historically, the approach for developing Joint Master Degrees has been related with the direct cooperation and settlement of an agreement between higher education providers and ADMIRE project's structure is based on the Knowledge Triangle, focusing on responding and striving for excellence in the cornerstones of the knowledge triangle, namely, to boost cooperation between education institutions, research organisations and business.

The current document has been developed under ADMIRE project work package 2 - Design of the MSc AM modular system as a draft guideline establishing the strategy for the setup, implementation and the fundamental rules and requirements related with the Metal Additive Manufacturing Joint Master (AM MSc), the AM MSc Council, quality assurance mechanisms, admission requirements and length of the studies cycle, developed to support the implementation phase of the AM MSc during ADMIRE Project and is composed by the following sections:

- **Quality Assurance**
- **Metal Additive Manufacturing Joint Master**
- **AM MSc Council**
- **Degree's Outcome Profile**
- **Length of the Studies Cycle and ECTS**
- **Admission Requirements and Vacancies**

It should be considered as a “living document”, in continuous improvement through the collection of good practices and development arising from the other project activities and a final version of this MSc's Rules and Requirements Guideline will be published in WP5 in output no. 5.6 “Report and guidelines compendium of the metal AM Executive Joint MSc piloting”, aiming to support the management, execution and improvement of the AM MSc beyond ADMIRE Project lifetime

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### **Quality Assurance**

AM MSc Quality Assurance Mechanisms are to be settled according to the European Approach for Quality Assurance of Joint Programmes, approved by EHEA ministers in May 2015, and the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). (2015). Brussels, Belgium.

This will support in one hand, the development of a European Approach regarding Quality Assurance, and, facilitate a future accreditation process in case ADMIRE project decides to submit a proposal for a Joint Programme Accreditation.

Although the possibility of submitting a proposal for a Joint Programme accreditation after ADMIRE Project will be furtherly discussed and assed in WP 7 (Dissemination and Exploitation), an annex has been prepared (Annex2 – Towards Sustainability: Quality Assurance Mechanisms for Joint Programmes), providing useful insights for that purpose.

Also possibilities of Accreditation Processes by National Engineering Councils of the Metal Additive Manufacturing Joint Master (AM MSc) will be explored by ADMIRE project.

Some of the key factors of Quality Assurance will be fully reflected in the current draft guideline, while others will be developed in other ADMIRE project deliverables such as the methodology for the design process, length of the joint curricula, its implementation and evaluation mechanisms for assessment of achieved learning outcomes (2.3 - Design Process' Draft Guideline and 3.1 Draft Guideline of the AM MSc's Purposes and Strategies Alignment).

### **Metal Additive Manufacturing Joint Master**

The Metal Additive Manufacturing Joint Master (AM MSc) aims providing to the EU current and future workforce the necessary knowledge, skills, autonomy and responsibility outcomes required for the metal additive manufacturing industry, thus contributing both for the employability (through the development of the right skills for the right jobs) and mobility (through the development of supporting mechanisms for the mobility within the European Union either of learners or professionals) of EU citizens within the European Union.

To provide a European response for this need, AM MSc follows the motto of a Joint Programme (JP), meaning “*an integrated curriculum coordinated and offered jointly by different higher education institutions from EHEA*”, as approved by EHEA ministers in May 2015 in the European Approach for Quality Assurance of Joint Programmes, although it's main purpose is not to develop an joint accreditation process, but to directly contribute for the fostering of the cooperation and innovation between the higher education provision and the metal additive manufacturing industry at EU level.

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From the point of view of ADMIRE project, to face the constantly technological updating and innovation that this particular sector is dealing with, the existence of an efficient multiparty council (AM MSc council) will be of most importance for the management of the AM MSc, in order to provide an up to date response to such a challenge and ensure Academia, Innovation and Business cooperation thus AM MSc sustainability and usefulness at long term.

### **AM MSc Council**

The AM MSc Council will be constituted by industry manufacturing representatives, teaching staff, researchers, and students. The engagement of the relevant parties to compose the MSc Council started in the very beginning of ADMIRE Project, and this process is fully described in deliverable 2.3 - Design Process' Draft Guideline.

It is of relevance to point out that within the frame of EU-level profile qualifications, EWF is also willing to recognize AM MSs for the purpose of its diploma awarding, thus contributing for the industry recognition at wider scope.

This Council will be created for the design of the MSc structure and for the definition of the scientific content, teaching, learning and assessment strategies. It will participate in the definition of the general MSc Learning Outcomes (LOs) and, specifically, in the definition of the LOs units for each module regarding suitable knowledge, skills and competences. LOs will be defined based on complete work-based learning and theoretical assignments, working processes, areas of work, work-based learning, fields of action or competence and specific for the AM MSc.

Additional members will be engaged by invitation based on their technological relevance to the sector.

### **Selection process**

→ representation of all Countries within the consortium (UK, Portugal, Germany, France, Sweden, Belgium)

### **Share**

During ADMIRE project:

- Industry: 50%
- Students: 25%
- Scholars (university + teaching staff): 25%

Assuming a size of 20 members:

- Industry: 10, from consortium members - 4 ADMIRE partners end-users

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- Students: 5. 4 ADMIRE university partners + 1 external
- Scholars (university + teaching staff): 5. 4 ADMIRE university partners + 1 external

To be contacted and engaged in the MSc Council during ADMIRE project:

- BAE; TechnipFMC; Airbus; Rolls Royce; Centro Ricerche Fiat Spanish RTO; Thales.

After ADMIRE project:

- Industry: 50%
- Students: 15%
- Scholars (university + teaching staff): 35%

The difference regarding the % in shares is mainly due to the fact that the engagement of students (both mature and fresh graduates), during the project lifetime is crucial to assess expectations and results deriving from the AM MSc. Complementary, it is also expected that the composition of the MSc Council will be enlarged after ADMIRE Project, therefore a slight adjustment in terms of representative shares is also expected.

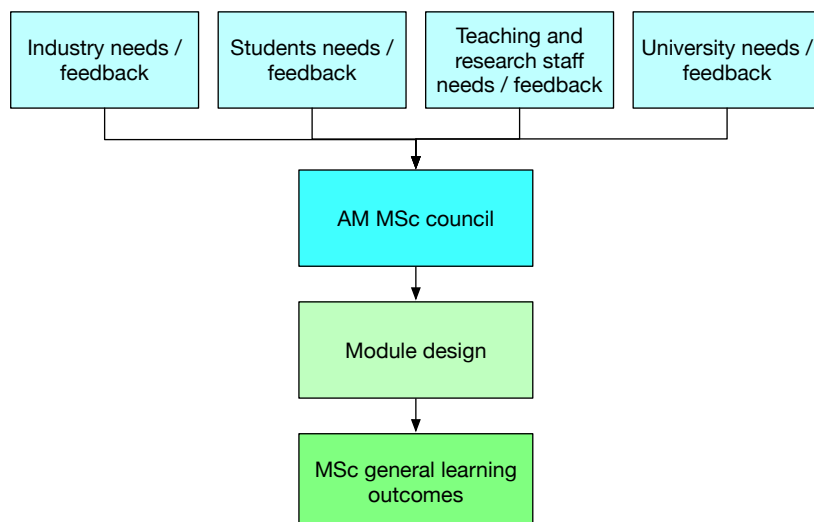
The MSc Council will schedule quarterly meetings during the project, and it's expected to have a meeting every 6 month afterwards. Physical meetings (location rotation) will be privileged, but in case of impossibility, virtual conference meetings will be arranged.

**Input:** minutes from meetings

**Output:** report containing list of recommendations

The AM Master Council will continue with the meetings to update the metal AM Executive Joint MSc structure (if necessary), its strategies, guidelines, contents and materials. This will be done based on the feedback, assessment of the targets, the external evaluation process and the lessons learned. It is also important to maintain these meetings in order to keep the Metal AM Executive Joint MSc running. In this line, the 'combined' teaching staff is also expected to continue exercising its activity, as there is shortage of qualified workman force.

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### Degree's Outcome Profile

The AM MSc is aimed at educating engineers, project development leaders and innovation experts in the emerging field of metal additive manufacturing (metal AM). Experts in metal additive manufacturing industries are lacking and becoming intensively looked after by companies and institutions acting namely in research and innovation, services and machine suppliers, and other relevant fields of activity such as welding and related technologies, gas suppliers and railway maintenance.

Looking into the current labour market requirements regarding a specific set of skills and competencies in the field of metal AM, AM MSc should be able to prepare its candidates for undertaking the following tasks and responsibilities upon completion of the programme:

- Evaluate manufacturing suitability for clients' requests defining which process is fit for the request, developing cost models and providing feedback concerning operating costs;
- Develop and execute custom and standard manufacturing plans for additive manufacturing, from validation of design, development, pre and post processing operations, parts conformity and to identifying causes and corrective actions of technical production problems;
- Coordinate the tasks distribution between the operators according to the workplan as well as manage the link between them and the management.
- Apply a wide variety of engineering techniques, will contribute to projects in a teaming environment and will investigate, transfer, and adapt processes, techniques, or methods to new applications.

In terms of general descriptors according to the EQF level 7 (and its compatibility with the second cycle of the Framework for Qualifications of the European Higher Education Area) regarding the outcome profile for the AM MSc, the following statements should be considered as starting point for the programme design:

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| ISCED LEVELS | EQF LEVELS | KNOWLEDGE  | SKILLS  | AUTONOMY AND RESPONSIBILITY   |
|--------------|------------|--|---|---|
| 7            | 7          | Highly specialised and forefront knowledge including original thinking, research and critical assessment of theory, principles and applicability of metal additive manufacturing processes and technologies. | Highly specialised problem-solving skills including critical and original evaluation, allowing to define or develop the best technical and economical solutions, when applying metal additive manufacturing technologies, in complex and unpredictable conditions | Manage and transform the metal additive manufacturing processes in a highly complex context.<br>Fully responsible for the definition and revision of personnel's tasks. |

### Length of the Studies Cycle and ECTS

The AM MSc aims to train specialists in the field of manufacturing engineering, at the level of the 2<sup>nd</sup> cycle of studies in emerging Metal Additive Manufacturing and is intended for candidates with a background at the level of the 1<sup>st</sup> cycle of studies, including coverage of Industrial, Process, Materials and Mechanical engineering.

At this early stage and based on the results deriving from deliverable 1.1 - Report on the different AM stakeholders' perceptions, AM MSc is foreseen to be designed for 1 academic year Master Course, with 80 credits, 30 for the academic pathway plus (1 semester) plus 20 for the group project (1 trimester) and 30 for the industrial thesis (1 semester).

The following table represents the conversion of the above credits into the national systems currently running in the different partner countries

| Workload distribution | AM MSc ECTS credits | UK credits |
|-----------------------|---------------------|------------|
| Academic Classes      | 30                  | 80         |
| Group Project         | 20                  | 40         |
| Industrial Thesis     | 30                  | 80         |

### Admission Requirements and Vacancies

#### AM MSc – Entry requirements

For the purpose of entry and admission requirements, beyond the ones described in the current draft guideline, additional national requirements if existing, should also be considered. Annex 1 in the current draft guideline details the current existing national requirements in ADMIRE Project Partner Countries.

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The following can apply:

- Holders of a 1st degree in the areas of Industrial, Process, Materials or Mechanical engineering, subject to curricular appreciation of the candidate.
- The program requires Metallurgy, Mechanical Engineering and Materials notions at the level of a first general engineering cycle;
- Holders of a higher academic degree conferred after a 1st cycle of studies organized in the above areas, in accordance with the principles of the Bologna Process by a State adhering to this Process;
- Holders of a higher academic degree conferred after the 1st cycle of studies, in those areas, outside the Bologna Process agreement that is recognized as meeting the objectives of the degree by the MSc Council;
- Holders of an academic, scientific or professional curriculum recognized by the by the MSc Council of the programme, as testifying the ability to carry out this programme;
- MSc Council employees from the representative industrial holders of a higher academic degree conferred after the 1st cycle of studies, willing to develop expertise in the field of Metal additive Manufacturing.

Also people without a formal academic recognition can apply for a place onto the course, including people with an Higher National Diploma (HND) or a full-time Higher National Certificate (HNC). These would have to be interviewed to assess their level of competence.

Part-time students can start at any point in time during the academic year.



Expected Vacancies available during ADMIRE Project:

| Vacancies                            | Partner          | Vacancies |
|--------------------------------------|------------------|-----------|
| Complete MSc                         | Cranfield        | 5         |
| Wire plus Arc Additive Manufacturing | CU/MTC           | 5         |
| LPBF                                 | MTC/Birmingham   | 5         |
| DED (Laser)                          | MTC/ Irepa/Beam  | 5 +1      |
| Electron Beam                        | MTC/Birmingham U | 5         |
| Modelling and Simulation             | Bremen           | 5         |
| Non-destructive Testing              | Técnico          | 5         |

Expected Vacancies available after ADMIRE Project:

| Within Consortium Universities | Other Companies engaged |
|--------------------------------|-------------------------|
| 50                             | 25                      |

## Annex 1 – Current National Requirements for a Master Degree

### UK

Here we explain the minimum entry requirements and the range of assistance available to help you meet them.

If you are an international student you may need to provide evidence of your English language proficiency when you receive an offer to study with us.

#### Minimum entry requirements

- A UK first (>70%) or second-class honours (60%-70%) degree in a relevant subject area:
- An equivalent international qualification (find out whether your qualification meets our requirements by visiting our International Student page) or
- Relevant work experience in combination with a degree below second class honours (<60%).

If you do not meet our formal entry requirements, but still feel you can demonstrate the ability to complete the course successfully, you may still be accepted onto the course. Each application will be considered on its merits.

#### English language requirements

If you are an international student you will need to provide evidence that you have achieved a satisfactory test result in an English qualification. The minimum standard expected from a number of accepted courses are as follows:

- IELTS Academic - 6.5
- TOEFL - 92
- Pearson PTE Academic - 65
- Cambridge English Scale - 180
- Cambridge English: Advanced - C
- Cambridge English: Proficiency - C
- Trinity College London Integrated Skills in English III - minimum overall score of pass

In addition to these minimum scores you are also expected to achieve a balanced score across all elements of the test. We may reject any test score if any one element of the test score is too low. Some courses may specify higher test scores so please check the details of your course for the English language requirements you will be expected to meet.

We can only accept tests taken within two years of your registration date, with the exception of Cambridge English tests, which have no expiry date.

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Students requiring a Tier 4 (General) visa will also need to meet the UK Home Office Tier 4 (General) student visa English language requirements. The UK Home Office are not currently accepting TOEFL or TOEIC tests for Tier 4 (General) visa applications. Other restrictions from the UK Home Office may apply from time to time and we will advise applicants of these restrictions where appropriate.

### **What can I do if I don't meet the English language requirement for my chosen course?**

If you have not met the appropriate English language requirement for your course, you could consider one of our Pre-sessional English for Academic Purposes (EAP) courses. They are offered to international students who do not meet the minimum scores as described above.

- Working with a team of well-qualified and experienced tutors, we will help you:
- Improve your English language skills to satisfy our entry requirement,
- Develop and improve your knowledge and use of academic English,
- Prepare for the kinds of assignments you will complete on your course,
- Gain the confidence and skills needed to succeed in your academic studies,
- Introduce you to life in the UK and to UK culture.

Winter and summer courses are offered each year, with students enjoying a choice of three course lengths, over 20, 10 or five weeks.

The winter programme has been designed for applicants for research programmes starting in the summer. Applicants for courses starting in September/October are strongly advised to apply for the summer English programme. Applicants must provide their most recent UKVI IELTS test to be considered, as we are unable to consider an international applicant who has taken an alternative English language test.

Applicants who have not met the standard entry requirements for any of the above courses should contact the Pre-sessional team further advice and guidance. All applications are considered on their merits, on a case-by-case basis.

### **Pre-Master's programme at KIC London**

International students who do not meet the direct entry requirements may qualify for the Pre-Master's programme at KIC London. Successful completion of the programme guarantees your acceptance onto your chosen degree with Cranfield University.

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## **Germany**

- evidence of having obtained a prior academic degree in an appropriately related field of study (e. g. a Bachelor degree with 180 ECTS or equivalent). The degree can be recognized;
- a final grade (or average grade at the time of application) better than or equal to certain CP from one or more of the main disciplines while studying on the prior degree course (don't know who set up this CP level or main disciplines, probably the MSc organizers) ;
- competence in the English language (proof should be provided); if the MSc is taught in English, the competence asked for is at a level of C1 according to the Common European Framework of Reference for Languages.
- a Letter of Motivation giving student reasons for choosing this particular program. The criteria for assessing applications are: The specific reference to the program, a clear and convincing depiction of student personal aptitude and goals, especially with regard to the relation between the content of the program and career expectations, and congruence between motivation to study and the program focus.
- CV (optional)
- If applicable, evidence of professional or other experience related to the field of study (optional)

## **Annex 2 –Towards Sustainability: Quality Assurance Mechanisms for Joint Programs**

Considering that a future accreditation process for a Joint Programme of Am MSc could be in place, it is strongly recommended that a team (AM MSc Quality Assurance Team, composed by members of the AM MSc Council and Higher Education partner institutions representatives) is settled for the preparation of a submission process.

AM MSc Quality Assurance Team should take care of the implementation of the internal quality assurance system and external quality requirements, following the European Approach for Quality Assurance of Joint Programmes, approved by EHEA ministers in May 2015, and the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). (2015). Brussels, Belgium.

By complying with this approach for external quality assurance and accreditation, AM MSc Quality Assurance Team should agree and decide on the selection of a suitable quality assurance agency from the list of EQAR-registered agencies to ensure external quality assessment and accreditation at programme level, that following the agreed standards and procedures of the European Approach will be able to carry out a single evaluation or accreditation of the entire joint programme.

This procedure ensures that the external quality assurance decision will be accepted and recognised in all EHEA countries where the programme is offered, as agreed in the Bucharest Communiqué.

During ADMIRE Project, it is of critical importance that contacts with National Agencies are undertaken, in order to ensure AM MSc accreditation and approval, since although under the umbrella of the European Approach for Quality Assurance of Joint Programmes countries shall not apply any additional national criteria, many countries still apply additional national criteria through national legislation, such as the need of separate national programme accreditations, inexistent legislation concerning recognition of foreign quality assurance agencies, national contradiction regarding ECTS attribution, etc.

The AM MSc Quality Assurance Team should also ensure during ADMIRE project that all partners have a common understanding of the Am MSc internal quality assurance system, that the responsibilities regarding the internal quality assurance is clearly shared and coordinated and that the quality assurance policy covers both the academic and administrative aspects of the AM MSc.

### **Principles and regulations to comply with in case of submission of AM MSc as a Joint Programme:**

#### **I Consortium, Governance and Management**

Good working relationships are a key factor for the success of AM MSc, and should be inherent to the selection of future Partners, as well as the added-value of this joint programme;

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All institutions must be recognized and/or accredited as higher education institutions in their (sub)national higher education systems and can legally offer AM MSc as a joint programme;

There shall be a consortium agreement, signed by the competent authorities of the partner institutions, stating overall partners responsibilities within the consortium and regarding the coordination of the joint programme.

A local coordinator assigned by each partner shall be identified;

The bellow aspects should be further detailed concerning Consortium, Governance and Management:

- Coordination and responsibilities regarding internal and external quality assurance;
- Financial organisation (including sharing of costs and incomes, charging registration and/or tuition fees, grants and fellowships);
- Amending, renewing or terminating the agreement;
- Changes in partnership;
- The consortium recognises the required financial (and administrative) resources and has a common policy on tuition fees
- A clear and transparent budgeting strategy is settled
- The partners agree on the proactive and reactive provision of information
- Type of degree (joint, multiple) and awarding modalities;
- “User-friendly” public information on the programme, including tuition fees, application process, enrolment, program, etc (including a dedicated website);
- The application procedure is organised transparently for all those involved and information regarding the application is shared among all partners
- Admission and selection procedures for students;
- Mobility of students and teachers;
- Examination regulations, student assessment and recognition of credits in the consortium;
- Teaching language(s);
- Administration of student’s data and performance records (jointly arquived);
- Support for student mobility;

## **II Teaching and Learning Outcomes**

Both the general Learning Outcomes of AM MSc (fully developed in deliverable 2.3 Design Process’ Draft Guideline) and each Module Learning Outcomes (fully developed in deliverable 3.1 Draft Guideline of the AM MSc’s Purposes and Strategies Alignment) are to be developed and shared by all partners and in alignment with the Master’s Degree corresponding level in the relevant qualifications framework;

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AM MSc Learning Outcomes should also satisfy the requirements of the joint programme's (research) discipline(s) and the professional field of Metal Additive Manufacturing;

The MSc Council has the responsibility of ensuring that the developed learning outcomes is confirmed by alumni, employers, professional organisations and the Metal Additive Manufacturing sector;

For the purpose of the curriculum implementation, a common teaching and assessment methodology should be undertaken (which will be fully developed under WP3);

### **III Students**

- The programme provides adequate services to students in order to facilitate mobility, the mobility model is clearly outlined, and all the necessary information shall be provided before (and on) arrival.
- The joint programme has a dedicated alumni network

Students Support Strategies will be fully developed in deliverable 3.2 Students' support strategies

### **IV Degree and diploma supplement**

To be further developed in deliverable 2.3 Design Process' Draft Guideline

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