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THE VALUE OF PEER-EVALUATION FOR THE IMPROVEMENT OF QUALITY OF THE AEROSPACE HIGHER EDUCATION ACROSS EUROPE

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ABSTRACT

The paper presents the results of a pilot project aiming at proposing a sector-specific quality system that can complement the existing national or European accreditation systems, providing added value to the internal and/or external quality assurance processes that are in place in most EU Universities. In particular, the proposed system implies a site visit from a group of peers to crosscheck and validate the data and documents prepared for the degree course under evaluation. The results of the implementation of this procedure on 8 Universities are discussed on the basis of the feedback provided, in order to assess the usefulness of the process as perceived by the provider of the aerospace degree.

Keywords: Aerospace Higher Education, Quality, Peer Evaluation

1 INTRODUCTION

Quality assurance has become a key word for most Universities across EU. Several procedures have been used to ensure the quality of the programs. They include an accreditation process conducted at the national level by an appropriate evaluation body. The evaluation is related to all the aspects of the organization of the training in the institution, including the resources, as well as the management of the studies.

Each individual country has its own accreditation system. The harmonization process of the different curricula across EU is more oriented toward the teaching contents and little account is taken regarding the accreditation schemes. Yet, in order to make the process reliable and check the reliability of the learning outcomes, a more appropriate and thorough evaluation is required [1]. It involves in-depth evaluation of additional important criteria, such as learning outcomes and their matching the industrial needs, which, *in fine*, make the core of the training process.

The objective of the present paper is to provide some information on the ongoing process, which is aimed at evaluating universities within a quality assurance framework. At this time, several aeronautical and aerospace universities were evaluated and the results of this investigation are analysed in this paper.

2 BRIEF DESCRIPTION OF THE PROPOSED QUALITY EVALUATION SCHEME

In most cases, the evaluation procedure scheme for accreditation is based on the ability of the university to manage its programs, its staff, the student life and budget etc. Moreover, besides verifying the previous points, a visiting team normally checks on site the resources (teaching and learning environments, teaching materials, teaching aids and equipment, premises,

financial resources) and verifies whether they support the achievement of objectives in the study program and can adapt to changing circumstances (change in student numbers, etc.) [2]. All these aspects definitely play an important role in terms of quality management; however, the coherence of the programs, their sustainability and their consistency with the industrial demand is another aspect, which makes the eligibility of the university for a label of excellence. This point raises the crucial criterion, which is more specifically looked at in the present investigation. Beyond the main criteria, which entitles quality, one needs to ensure that the programs are fit to the diploma attached to the training, as well as the response of the industrial party in terms of employability. Alumni and their employers must be satisfied with their professional preparation and social competences [3].

Teaching and learning, which involve modern flexible teaching methods in order to facilitate the achievement of learning outcomes is a key factor. In other words, the main objective, beyond the content of the taught material, is to measure how well this material has been acquired and can be put into practice upon the career development. The process of teaching and learning must also support learning mobility, which includes a slightly high rate of internationalization. This latter point implies that qualified foreign and visiting teaching staff and practitioners participate in teaching within the study program. Moreover, students' study as foreign or visiting students at foreign higher education institutions should be part of their studies [4].

Finally, research is another part of the qualification for excellence. This aspect was more specifically examined within the PEGASUS network, since, nowadays, research is very much linked to the development of novel technology. For this purpose, students and researchers are working in close collaboration with industry and, moreover, the teaching staff must be engaged in professional and teaching-skills development.

These aspects have been taken into account in the proposal for a unified European scheme for the quality evaluation of the aerospace higher education, through the PERSEUS project that has been financially supported within the H2020 framework [5]. The project has been proposed by a large group of Universities participating also in the PEGASUS network and has later incorporated further Universities that acted as volunteers to test the proposed procedures and mechanisms.

Overall, the following EU countries and Universities have been involved in the study: Italy (Politecnico di Milano, Politecnico di Torino, Università degli Studi di Napoli "Federico II", "Sapienza" Università di Roma), Spain (Universidad de Sevilla, Universidad Politécnica de Valencia), France (ISAE-ENSMA Poitiers, ENAC Toulouse), Portugal (IST Lisbon), Netherlands (TU Delft), Czech Republic (CVUT Prague), Slovakia (University of Zilina), United Kingdom (University of Liverpool), Greece (University of Patras).

The main goal of the procedure is to provide the quality assurance of engineering education within European Higher Education Area in the sector of aerospace engineering and sciences. The quality requirements and methods of quality assessment correspond to the needs of European aerospace industry, research and academia and at the same time they are compatible with up-to-date generic quality assurance system for engineering education represented in Europe by EUR-ACE System. This system is also compatible with the Anglo-Saxon system represented by the Washington Accord and the International Engineering Alliance. The PERSEUS quality assurance system assesses the quality of education by the level of acquired knowledge of different aerospace learning objectives, skills and abilities by graduates which is focused mainly on outcomes.

The designed evaluation procedure does not replace national accreditation and can be applied only to already accredited programs. The evaluation process however can be performed as a piggy-back of existing national accreditation process on the condition that the national accreditation process is outcomes-based. In the case of EUR-ACE accreditation, the piggy-

backing can be used for generic parts of the evaluated curricula.

The evaluation process is based on a peer-review of the self-assessment report prepared by the University and on a site visit by the visiting team of reviewers.

The basic part of the PERSEUS process is the PERSEUS documentation containing the information concerning the assessed engineering curricula and its analysis and self-assessment report as well as the evaluating report of the visiting team.

All the documents and the prescribed light procedure are designed in a way to clearly define all items which are subjects of the assessment of the high-standard aerospace curricula at master level.

If the aerospace engineering program is not subject of the EUR-ACE® accreditation process (or similar) and does not hold the EUR-ACE® Quality Label, the evaluated University is asked to prepare the self-assessment report which includes:

- a) the form PERSEUS Curriculum Description Table
- b) the structured template of the Visiting Team Report

If the aerospace engineering program is subject of the EUR-ACE® accreditation process (or similar) and holds the EUR-ACE® Quality Label, the PERSEUS procedure is then simplified by piggy-backing only to:

- a) the form PERSEUS Curriculum Description Table
- b) In a piggy-backing procedure, the Visiting Team Report includes only those elements which have not yet been assessed in the basic procedure.

The PERSEUS Curriculum Description Table is a very compact form of presenting the learning outcomes of the evaluated programme. It is divided in two sections, one for knowledge (technical) and one for skills (personal). The knowledge is expressed in the form of level of achievement (none, basic, intermediate, advanced) of 30 learning outcomes, 2 for each of 15 knowledge areas identified as important for the aerospace sector. The definition of the learning outcomes has been done in close collaboration with the EU employers in the sector.

The visiting team presents at the end of the visit its basic opinions regarding the quality and performance of the evaluated engineering program, their observations to the University representatives and to the head of the program and also the eventual recommendations for its improvement. During the discussion with the University representatives the assessment provided by the visiting team should be clarified and final decision accepted. At the end of the visit the visiting team formulates a report.

A graphical layout of the PERSEUS process is shown in the flow chart of figure 1.

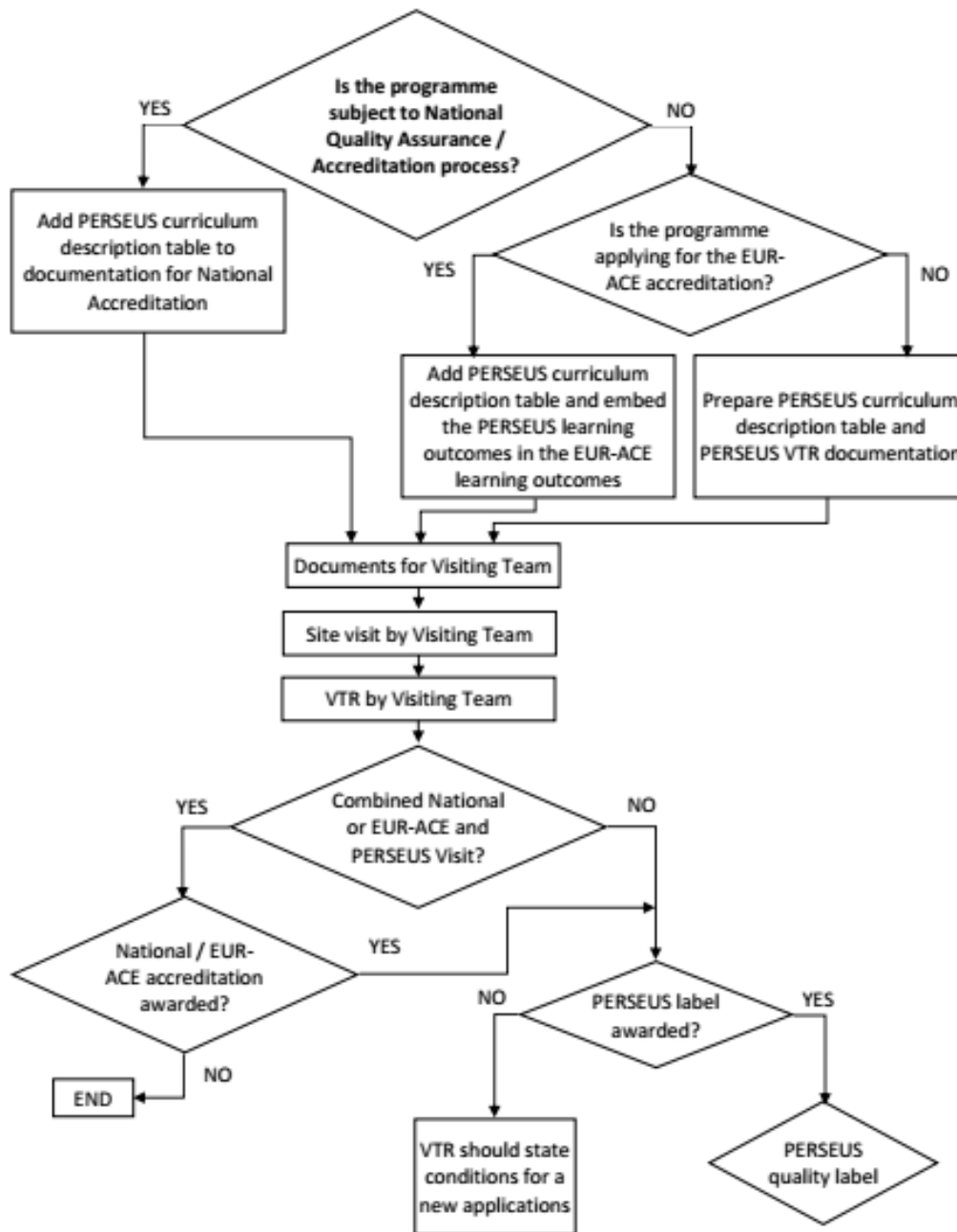


Figure 1: graphical flow chart of PERSEUS procedure

3 THE 8 TESTS IN EUROPEAN UNIVERSITIES

The practical use of the designed PERSEUS procedure was tested on altogether 8 different universities across the EU.

To test the ability of the PERSEUS assessment procedure to cope with different examples of aerospace engineering programs and educational systems, 5 Universities of the PEGASUS network and 3 non-PEGASUS universities were chosen in different EU member states geographically distributed to Western, Southern and Central Europe.

The PERSEUS procedure was applied to the following PEGASUS Universities:

- France – ENAC Toulouse. The evaluated Engineering degree program has been IENAC, 3 years following 2 years of Higher School Preparatory Classes.

- Spain – UPV Valencia. The evaluated Engineering degree program has been the 4 years bachelor plus 2 years master.
- Italy – “Sapienza” Università di Roma. The evaluated Engineering degree programs have been the 3 years bachelor plus the following 2 years master: MAER, Aerospace program leading to the Master of Science Degree in Aeronautical Engineering, and MSAR, Aerospace program leading to the Master of Science Degree in Space and Astronautical Engineering.
- Netherlands – TU Delft. The evaluated Engineering degree program has been Aerospace Engineering, 3 years bachelor plus 2 years master
- Portugal – IST Lisbon. The evaluated Engineering degree has been the Integrated Master level program (5 years) in Aerospace Engineering.

The PERSEUS procedure was applied to the following non-PEGASUS Universities:

- Greece – University of Patras. The evaluated Engineering degree has been the Mechanical Engineering and Aeronautics (3 years bachelor plus 2 years master).
- Slovakia – University of Zilina. The evaluated Engineering degree has been the Air Transport (3 years bachelor plus 2 years master).
- United Kingdom – University of Liverpool. The evaluated Engineering degree has been the Aerospace Engineering (3 years bachelor plus 1 year master).

The tests proved the full feasibility of the procedure and its function. In all tested cases the final assessment and ranking was achieved.

The PERSEUS procedure was also tested together with in parallel ongoing EUR-ACE audit in two cases, at the University in Rome and at the IST in Lisbon. In both cases the coordination of two parallel audits was very demanding and also the EUR-ACE self-assessment reports were edited in the national languages (Italian and Portuguese) so it was not possible to use a piggy-backing and focus only to the sector-specific evaluation.

But a great advantage of the presence of Royal Aeronautical Society of the UK in the visiting team was noted during the evaluation of the aerospace engineering program at the University of Liverpool. It indicates that the presence of a member of EUR-ACE Accreditation Agency in the PERSEUS visiting team is very helpful in the quality assurance and evaluation procedure.

It is emphasized that the main goal of the PERSEUS process is the evaluation of the quality of the aerospace curricula in the European context, that is its main focus is on quality assurance, whereas the accreditation of the programme can be seen as an optional extension of the process in the future.

4 FEEDBACK FROM THE VISITED UNIVERSITIES

Following the site visits and the completion of the Visiting Team Report by the visiting team, the Universities under test have been asked to provide a feedback in order to assess the usefulness of the PERSEUS process as perceived by the provider of the aerospace degree. The opinion on the following points has been asked in particular:

- Validity of the process (“do you think that the PERSEUS process is a valid tool to assess the quality of the education in the aerospace engineering curriculum?”)
- Effort required (“is the effort put in preparing the documents and the visit worth the result?”)
- Synergy with national accreditation (“how does the PERSEUS process fit within your national processes on accreditation?”)
- Major benefits of PERSEUS (“what is, if any, the major benefit you obtain from the PERSEUS process?”)

6 Universities provided their impressions, some of which are quoted hereafter.

4.1 Validity of the process

Feedback from UPV Valencia:

Yes, it is. On one hand the evaluation is made by your peers. Moreover, as these colleagues come from different countries and universities or research centers it is an excellent opportunity to test your School against colleagues that do not necessarily share your own country views in the field of higher education. Notice that this also eliminates a possible biasing in terms of vicinity that could be both positive or negative.

4.2 Effort required

Feedback from UPV Valencia:

Yes, certainly. It was an opportunity to check our Master and Bachelor and a perfect way of improving it. We could detect some aspects that are not enough covered by our accreditation system. Moreover, we are passing all the documentation to the Vice-Chancellor of Quality to convince him of the quality of the title and the importance of the PERSEUS Label.

Feedback from “Sapienza” Università di Roma:

Yes! Preparing the documents allowed us:

...

(iii) to involve most of the teaching staff and a broad cross section of students, making them aware that we are constantly evolving curricula currently ongoing.

4.3 Synergy with national accreditation

Feedback from IST Lisbon:

.... We see the PERSEUS process as more focused on contents and less time consuming on subsidiary issues, with two implications: We would not mind if the PERSEUS process was the only accreditation procedure replacing the national one. Also we can see the PERSEUS process as a complement to the national accreditation, because we can use the same data, except for the PERSEUS tables that have the benefit of greater insight into the contents of the course. The PERSEUS process remains a worthwhile addition to the national accreditation even if it does not replace it.

4.4 Major benefits of PERSEUS

Feedback from IST Lisbon:

There are several interlinked benefits. It highlights the subjects that are the focus of our degree and the way we strive for quality. It is very beneficial to have a group of independent experts advising us on our degree. It allows a comparison of our approach with other universities we take as our peers or models.

Feedback from University of Patras:

PERSEUS was the first time we did a specific evaluation of the aerospace curriculum in detail, which has helped us to identify both our strong points and weaknesses. It is characteristic that the comments we received from PERSEUS curriculum evaluation process have been the basis for our discussions and actions in the frame of the Aeronautical Committee of our Department (comprising five members of the Aeronautical Division of the Dept.), towards the improvement of our Aerospace curriculum. Finally, exchange of experiences and homogenisation of ideas with the respective European departments has been highly beneficial.

Feedback from University of Zilina:

There are several benefits resulting from the project:

- (i) We got the opportunity to participate in the evaluation process of other universities and had a chance to benchmark our institution with them We obtained an independent opinion of external experts on the quality of education at our university*
- (ii) We had an opportunity to be a part of team of top professionals, could exchange views on different subjects and established links for further co-operation. This creates also synergies for other possible projects.*

5 MAJOR ADDED VALUE OF PEER EVALUATION

According to the opinions of the University staff involved in the peer evaluation, some strong points clearly emerge as added value, compared to other types of evaluation of the curriculum. It is here recalled that the visiting team is composed by a mix of academic and non-academic experts in the aerospace domain.

The first point that can be highlighted is the appreciation that “The evaluation is made by your peers”. Furthermore, since the visiting team is typically international, the combination of visit and discussion with the host University is seen as “an excellent opportunity to test your School against colleagues that do not necessarily share your own country views in the field of higher education”. Similarly, “we obtained an independent opinion of external experts on the quality of education at our University”.

A second group of positive comments relate to the fact that the experts in the visiting team must also critically analyse the curriculum offered by the University under evaluation, proposing improvements and highlighting eventual weak points. This is appreciated due to the constructive approach adopted, so that “We could detect some aspects that are not enough covered by our accreditation system”, and “PERSEUS process more focused on contents and less time consuming on subsidiary issues”.

A third consideration relates to the formation of the visiting teams, where experts often have also participated in the evaluation of their own University with a different role. In this case, the dual function is beneficial since “We got the opportunity to participate in the evaluation process of other universities and had a chance to benchmark our institution with them”, as well as “We had an opportunity to be a part of team of top professionals, could exchange views on different subjects and established links for further co-operation”.

Another consideration relates to the involvement of the Faculty in the process. In the preparation of the documentation and during the visit, the participation of Faculty and students is required to some extent, variable from case to case. This is extremely useful for internal communication, since “Preparing the documents allowed us to involve most of the teaching staff and a broad cross section of students, making them aware that we are constantly evolving curricula currently ongoing”.

6 CONCLUSION AND THE WAY FORWARD

The PERSEUS project was terminated at the end of 2016 and brought up some significant results. Testing the PERSEUS methodology on 8 voluntary universities with various programmes in different countries showed the adequacy of peer-evaluation and the robustness of the evaluation scheme. Similar to standard accreditation procedures, the PERSEUS scheme includes a voluntary approach by the University requesting one of its programmes to be evaluated, a self-assessment by the University of that programme, based on criteria set by PERSEUS and a peer-evaluation aiming at consolidating the self-assessment with on-site verifications.

This process combines quantitative and qualitative criteria, using expert judgment to make synthetic recommendations in the end. This requires the availability of an expertise pool in a series of domains, that PERSEUS was able to constitute for the purpose of the project. It is

now necessary to consolidate that reservoir of expert people, able to devote some of their time to the process of reviewing, analysing and making recommendations on a longer-term basis. This is all the more important for the future that other entities like national accreditation agencies for instance may be interested in tapping that source of expertise too. This already happened at the end of 2016 when some PERSEUS experts were requested to join an accreditation team for aeronautical programmes in an Eastern European country.

Another important line of action in the future is to reinforce the link that PERSEUS was able to create with the Aerospace industry. The industry's contribution is essential to the process, since it allows to quantify the skills needed on the job market in terms of nature and level. Knowing prospective needs of a series of companies allows for a precise analysis of the existing academic offers, where they match those needs and where they don't. Subsequently, it is a useful tool for Universities to make their educational programmes evolve towards a better adaptation to the industrial needs.

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