

## **A UNIFIED BSc CURRICULUM FOR PRODUCTION ENGINEERING**

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### **ABSTRACT**

*Granted by the EU Programme Leonardo da Vinci, a two-year pilot project, EPRODEC (European Production Engineering Certification) has been started. The aim of EPRODEC is to provide an appropriate "European label" to the graduates of the accredited Production Engineering (PE) programme. The objective is to develop an accreditation system and organisation that will implement the certification process for education and training within the field of Production Engineering all over Europe. Creating a unified accreditation system will make it easier to compare qualifications and skills. The paper presents some of the ideas behind EPRODEC and the first results.*

**Keywords:** Production Engineer, Education, Certification System, Curriculum, Accreditation

### **1. INTRODUCTION**

European companies must be capable of manufacturing products of superior quality at competitive costs to compete effectively in the global economy. Key to the quality of any product is an understanding of the manufacturing processes by which it is produced. Many different studies undertaken in recent years to define the most important areas of future industrial research have placed production understanding at or near the top of the list [1, 2]. In order to achieve products of superior quality it is consequently necessary to have adequately skilled, trained, and educated production engineers who understand the manufacturing processes.

The changes taking place in industry, as manufacturing shifts to new processes aimed at increased productivity, are followed by new views of the educational system and of the training received by production engineers who will plan, implement, and operate the new advanced manufacturing systems. Given the variety of activities undertaken in manufacturing and the variety of products involved, there is a considerable uncertainty about what a production engineer is in terms of education and training. A matter closely connected to this is how the knowledge can be certified.

Modern production engineers must be able to perform a wide variety of tasks with steadily increasing complexity. In this context, it is especially important to provide production engineers with cross-disciplinary knowledge since this is vital to changing technology and international competition. Production engineering curricula must therefore keep pace with the changes demanded by future trends in advanced manufacturing. A homogenous production engineering curriculum that specifies the most important areas in this field and a European certification system that can measure the skills and the educational knowledge level are therefore of great importance [3].

## **2. PROJECT DESCRIPTION**

In order to develop and to specify a curriculum and a European certification system for production engineers, the pilot project EPRODEC (European Production Engineering Certification) was started in February 2007. The project, which is granted by the EU Programme Leonardo da Vinci, is running for two years. The partnership consists of representatives from universities, European federations and organisations. The aim of EPRODEC is to provide an appropriate “European label” to the graduates of the accredited Production Engineering (PE) programme in conformity with the framework specified by the EUR-ACE Standards for the Accreditation of Engineering programmes. The objective is to develop an accreditation system and organisation that will implement the certification process for education and training within the field of PE all over Europe. Creating a unified accreditation system will facilitate the mobility among production engineers since it makes it easier to compare qualifications and skills. The long term goal is to improve skills and qualifications in basic PE up to BSc. level with the purpose to promote the employment reliability and the transnational mobility. This will be facilitated via a European Certification. For this goal, EPRODEC will establish a transparent training and certification system to improve students' professional qualification for a common European labour market. Organisational structure, quality assurance, methodology, and rules for important areas such as e-learning, distance work, mentorship, collecting and recycling valuable information from retiring workers will be dealt with in the project. This will undoubtedly strengthen the quality in VET (Vocational Education and Training) systems and practices [4].

## **3. ACCREDITATION SYSTEM AND ORGANISATION**

The main goal of EPRODEC is to establish a unitary, transparent European training and certification system for Production Engineers based on EUR-ACE Framework Standards for the Accreditation of engineering programmes. In the EPRODEC project the EUR-ACE framework standards will be applied for PE. EUR-ACE is an EU-supported project coordinated by FEANI [5] with the aim of setting up a European accreditation system for the entire engineering sector. In this context, the EUR-ACE Project elaborated and published in December 2004 was a first version of tentative EUR-ACE Standards and Procedures for the Accreditation of Engineering Programmes [6].

The major elements in the EPRODEC system are:

- An educational plan – “EPRODEC Curriculum”
- An educational package – “EPRODEC Educational resources”
- Procedures and practices for assurance and maintenance of academic standards – “the Quality Assurance Manual”
- A European organisational structure – “EPRODEC Accreditation Body”
- A validation instrument to attest acquired knowledge of both educators and trainees – the “European Production Engineer Certificate”

In Figure 1 the EPRODEC organisation structure, that will be created, is outlined. The EPRODEC accreditation body and its central agency, the European Accreditation Office for PE within FEANI, will act as the management of the certification process, analysis and dissemination of information for the improvement of the quality of VET in PE. The organisation will actively strive to mobilise VET resources in PE throughout the European Union to provide high quality evaluation of production education and training, to supervise training programmes, and to provide useful and clear information to certification institutions. The central agency will coordinate efficient and transparent procedures to allow timely access and to license competent institutions to promote and uphold the standards.

International collaborative activity poses particular problems and issues for the management and enhancement of the quality of teachers' experience and the assurance and maintenance of academic standards. The Quality Assurance Manual (QAM), that will be developed, addresses those issues and lays down procedures and practices, which will be kept under constant review to guide the certification institutions and their staff in the certification process. The QAM will ensure that the learning opportunities for PE students, the totality of their experience, and the standards of the qualifications they receive are of the highest quality within the resources available and independent of the institution issuing the certificates. The QAM will form the base of the European training centre. The intention is to widen the already existing European network. The network will consist of Education Centres forming satellites around different universities/institutes.

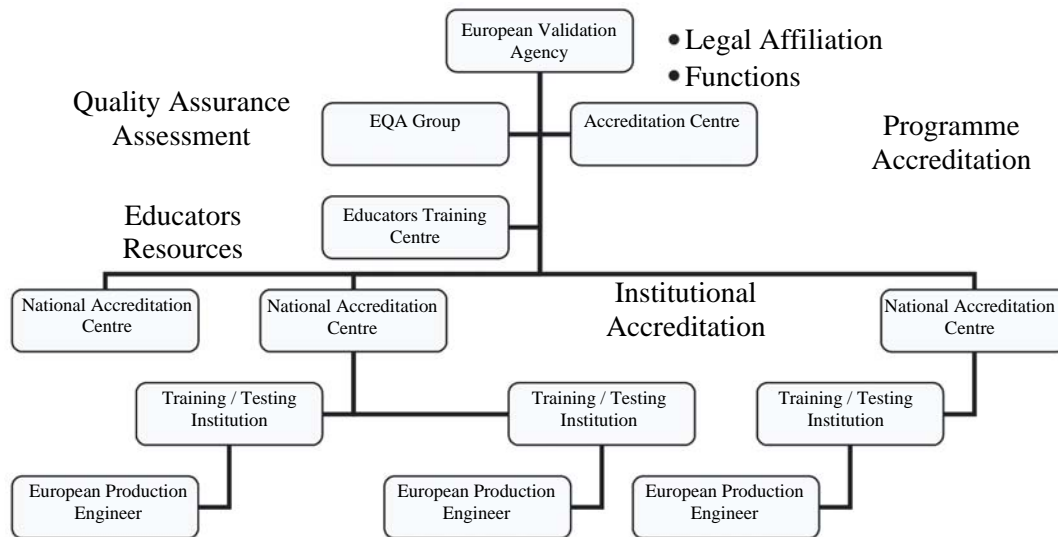


Figure 1: EPRODEC organisation structure

The curriculum framework for PE certification was developed in a previous LdV project, EPRODE. The structure is based on industrial input, such as questionnaires among industry employees and courses for production engineers. During the development process of the curriculum, national differences and aspects were considered. The certification makes it possible to specify and maintain the realistic and European standards of professional competence for a common European education and training in PE. The certificate is the final proof that the student has the ability and necessary qualifications to work as a production engineer. It is a driver's license for the field of PE and the final stage of an iterative procedure. The certification system will not only be a grading system, but it is also an instrument for specifying and dealing with different activities during education and training. Within the EPRODEC a complete course package framework the "EPRODEC Educational Resources", will be developed to lay the foundation for accredited institutions. Since the vocational training will take place at many different European locations, it is essential to develop an instrument, a certificate that guarantees the quality. Quality assurance is thus an important feature of EPRODEC.

#### 4. CURRICULUM

Basically, the function of a unitary PE curriculum can be summed up as a clear and concise statement of what matters in PE education. This translates the EPRODEC educational mission into concrete terms for key areas of learning and thus focuses teaching on shared goals. The EPRODEC curriculum focuses on a modular programme of study and outlines the intended knowledge, understanding, skills, and attributes of a student completing that particular module. EPRODEC curriculum consists of 12 modules, each of them rated at 15 ECTS (see Figure 2).

EPRODEC modules contain courses that cover major areas in production engineering and management. The PE "core" modules provide a common language and fundamental base for all production engineers. Technological disciplines are designed to be unique and specialised. To date, EPRODEC encompasses three specialisations: Forming, Machining, and Joining.

The EPRODEC modular structure is based on a unitary combination of theoretical or basic knowledge necessary to understand competence courses, practical activities performed in laboratory or industrial companies as well as language and culture courses to enlarge the European dimension (see Figure 3). Emphasis has also been placed on the communication skills of reading, writing, listening, and speaking in both technical and non-technical courses. The degree of standardisation of the European PE programme will be reflected by curricula, educational material, resources, quality assurance systems, and the process for continual programme review. However, high flexibility is ensured to adapt to national industry demands and to shape student identities in the light of structural features of different national industry profiles.

Module I, 15 ECTS	Module II, 15 ECTS	Module III, 15 ECTS	Module IV, 15 ECTS
Materials Engineering	Manufacturing Technology	Integrated Product and Process Design	Quality Engineering
Module V, 15 ECTS	Module VI, 15 ECTS	Module VII, 15 ECTS	Module VIII, 15 ECTS
Information Technology And CNC	Production Management	Forming Technology Bulk Forming	Forming Technology Sheet Metal Forming
Module IX, 15 ECTS	Module X, 15 ECTS	Module XI, 15 ECTS	Module XII, 15 ECTS
Machining Technology	Manufacturing Systems	Joining Technology Welding	Joining Technology Mechanical & Chemical

Basic modules
  Specialisation modules

Figure 2. EPRODEC curriculum structure

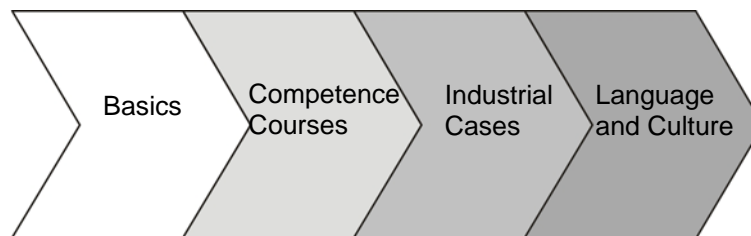


Figure 3. EPRODEC module structure

## 5. CONCLUSIONS

This paper underlines the importance of creating a unitary education programme for production engineers and a European accreditation organisation that can certify both production engineers and their certification institutions. A transparent training and certification system for production engineers will ensure both quality and a high standard for education and training. This will substantially ease mobility among European production engineers and will also be a basis for higher standards in many European companies, especially SMEs.

## 6. ACKNOWLEDGMENTS

This paper is based on the description of the Leonardo da Vinci project EPRODEC. The authors would like to thank the EU Commission for the financial support and all the partners of the project.

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