**Promoting mobility and employability by harmonising engineering programmes accreditation criteria**

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**Summary**

The development of an EU member state educational tissue is paramount to the building of a world class educational system which must fuel sustainable economic development. The contemporary reality of mobility and employability of engineering professionals across EU member states and overseas is one that is highly dependent on full participation of higher educational institutions in aligning their programme outcomes to an academic quality label that will offer employers a benchmark statement of the level of engineering education and professional experience undertaken by first and second cycle engineering programmes and other forms of recognised engineering training and development of candidates raising them to a fully qualified status of engineering practitioners. Moreover the benchmark statements must not only cater for first and second cycle engineering education but to expand and fully support doctoral qualifications and lifelong learning and be monitored by accrediting agencies through the establishment of appropriate professional engineering ranks which indicate to employers the commitment of the individual to engineering career development.

This paper presents a critical reflection of mobility and employability in the context of engineering programmes accreditation focusing on existing standards and auditing experiences and correlating criteria of the UK Standards for professional Engineering Competence (UKSPEC) and the European Accreditation of Engineering Programmes (EUR-ACE).

1. **Introduction**

Europe’s commitment through the Bologna declaration of 1999 was in its days the furthest Educational Systems could hope to higher education output harmonisation and criteria alignment. In its action programme a deadline of 2010 defined a European space for Higher Education where the employability and mobility of citizens would increase the international competitiveness of Europe.

The year of 2010 has come and gone and since then, although most of its framework has been successfully deployed, the European dimension in quality assurance has not been fully adopted to the extent where social benefit can be easily identified on the ground. Given that this was in itself one of the objectives of the Bologna declaration is important to reflect where Europe is and what more can be done.

This so important stimulus, which signals to employers the degree of comparability in higher education systems in hiring citizens from the signatory states, can only be achieved if the take up on quality labels which reflect equitable criteria and methods is widespread. Social awareness is however poor when compared to the scale and the endeavours of the project.

To date, whilst agencies of the European Network for Accreditation of Engineering Education exist, the number of participating establishments across the signatory states is disappointing considering the numbers of Higher Education first and second cycle engineering programmes with the EUR-ACE label.

The levels of public awareness have not been significant to have the Bologna objectives clearly identified with Educational, Industrial and Commercial stakeholders. These stakeholders include, Higher Education Institutions or those conferring awards matching first and second cycle qualifications, employers, both large corporate entities as well as small and medium enterprises and those who work very thoroughly on recruitment strategies and pay close attention to the educational quality standards and labels to recruit the best candidates for a job.

Presenting considerations for one of the Bologna signatories, the United Kingdom has a long history of Higher Education quality standards and systems with dedicated agencies like the Quality Assurance Agency which protects the public interest by checking how universities and colleges maintain their academic standards and quality, and this work is supported by a range of guidance developed in cooperation with the higher education sector, principal among which is the UK Quality Code for Higher Education.

The Engineering Council UK via its 36 designated engineering institutions has since the 1960’s maintained a register of professional engineers and technicians. Through UK-SPEC engineering describes the value of professional membership, career development and lifelong learning with clear specifications of the levels for attainment of the different professional engineering and technology categories.

The current European portrait of engineering accreditation is a mix of national practices and in this article we explore the key influences that quality labels such as EUR-ACE and UKSPEC can have on building a world class educational system for Europe and how this can foster mobility and employability.

1. **World Class Education for Europe**

Defining world class education is no doubt challenging but academic practitioners with experience can empirically define it as a combination of four high level components. These are: academic standards, research and innovation, lifelong learning and sustainable economic competitiveness.

Figure 1 - World Class Educational System

Education quality frameworks reassure public confidence in academic standards, recognise the embedding of research into the curriculum and identify innovation through engineering disciplines which focus their output on engineering project work. These disciplines are responsible for promoting the unlocking of talent through innovation and act as a stimulus of lifelong learning.

Lifelong learning for an engineer encompasses the keep of a personal development plan detailing the knowledge and skills developed through his/her career, a reflection on the level of proficiency attained in the different job roles and responsibilities and identifying plans and making preparations to undertake training to bridge the gap between contemporary engineering practice required for a sustainable economic development and the level of individual professional knowledge and ability.

Building a world class education system in a Europe where the priorities since 2008 have turned towards the finding of solutions to address the deepened problems of the financial sector should not discourage those with passion for education to continue to highlight to governments that a solution lies in highly qualified citizens who can through research and innovation develop the ideas that will make the banking engines roar once again. In practical terms this implies too, recognising those qualified engineers that work in research and development with or without a European Qualification Framework level 8 qualifications.

Current educational quality standards both in UK and at EU level fall short of this and pay limited recognition to lifelong learning. The concept that one education will fit an individual’s working life is not conducive of sustainable economic development nor does it promote innovation. These factors cause a negative feedback mechanism that hinders employability and mobility. Engineering programme accreditation standards have to be cohesive to the definition of achievement of a goal which seems agreed by many as the building of a world class educational system for Europe.

It is therefore vital that engineering programmes accreditation criteria promote suitable objectives and related outcomes which support the relationship between academic standards, research and innovation, lifelong learning and sustainable economic competitiveness which inform a world class education system made of employable engineers where the vacancies exist.

1. **Employability and Mobility**

The concept of employability is in constant review, and some historical milestones are identified here to have contributed to its better social understanding. The QAA report on employability of higher education, (Yorke, 2006) develops the idea that employability is not the same as employment, for the simple reason, that it involves the capacity of the graduate to function in a job. Employability as a curricular process is one that facilitates the development of the core and transferable skills appropriate for employment as well as the students’ reflection on their learning and experiences.

In the UK, despite having a fairly wide view of employability, the Dearing Report (Dearing, 1997) chose to focus attention in recommending the key skills of communication, numeracy, the use of information technology and learning how to learn.

The employability work of (Yorke, et al., 2003) recognises the initial characteristic of the work of (Mayer, 1992). Core (key) skills and transferable (generic) skills are defined. However the work of (Yorke, et al., 2006), mirrors the recommendations proposed by the (ACCI/BCA, 2002), takes the definition of employability to a more complex construct which includes the academic value of acquiring soft skills. These include, for example, a person’s emotional intelligence quotient and the cluster of personality traits.

Current thinking of employability extends the social understanding of this phenomenon to the context of the state of a nation’s economy and the concept of lifelong learning and calls for more integration of learning theories in the implementation of employability into the curriculum. This implementation is not of type “one size fits all” as one needs to be sensitive to the regional and national labour markets, sociological trends of student recruitment and the importance of economic prosperity, creativity, innovation and entrepreneurialism in the workforce. Evidence of this thinking can be found in (Yorke, 2006)

The (UK Commission for Employment and Skills, 2009) presents the latest philosophy of UK employability. The report identifies challenges, action points and good practice for: employer engagement; leadership and resources; and programme design and delivery. This research, in its appendix C, provides a synoptic overview of twenty definitions of employability skills, with a view to raise prosperity and opportunity of individuals, employers, government and society in general. These range from knowledge and understanding of a subject discipline to analysis, problem solving, and critical thinking, including self-management and self-awareness to name a few of the criteria.

One of the most recent key reports identifying the challenges of mobility is that commissioned by the European Commission, Directorate General for employment, Social affairs and Equal Opportunities (Danish Technological Institute, 2008).

Job mobility, as described by (Danish Technological Institute, 2008) involves movement between employers; between occupations, steps on the career ladder and unemployment mobility. The report presents an inverse U-shaped relationship between overall job mobility and economic growth with mobility contributing significantly to innovation, particularly in knowledge-intensive sectors, with very low levels of mobility as well as very high levels being detrimental to economic growth. Europe enjoys high job mobility in the age groups of 25-34 and 35-44 with a positive correlation of job tenure between 4-10 years as ideal in the U-shaped relationship between mobility and productivity. Flexible contractual arrangements, effective labour market policies and comprehensive lifelong learning policies are also appointed as contributing factors to job mobility.

Key findings of this report indicate that education and training policies (including lifelong learning) should focus on maximising employability of the individual.

It is well understood that employability does indeed promote mobility and has a positive impact on sustainable growth. Engineering programme accreditation criteria must focus on requirements that emerge out of the common goal of building a world class European education system where quality systems allow the quick comparison of standards of achievement by engineers at whatever stage of their career they may be, and that these standards have employability at the heart of their assessment criteria.

1. **UKSPEC and EUR-ACE**

The professional, statutory and regulatory bodies (PSRB) play a key role in our society, and especially in promoting employability and mobility of citizens. In UK the PSRBs set the standard for professional competence which academia, businesses and industry adhere to. The standards describe the value of professional membership, career development and lifelong learning with clear specifications of the levels for attainment of the different professional engineering and technology categories.

The formation process through which Engineering and Technology professionals become competent in UK generally involves a combination of formal education and professional development. However these two elements are not necessarily separate or sequential and may not always be formally structured.

UKSPEC is a standard published by the UK Engineering council and is governed by a Board representing the major professional engineering institutions in the UK as well as individuals, industries and sectors with an interest in regulation of the engineering profession. The standard defines ranks of engineering proficiency with the top level being that of Chartered Engineer (C.Eng.). The achievement of such a standard is depended on successful completion of an academic second cycle qualification in an engineering discipline, work experience standards measured by competency areas and a professional development interview.

The successful integration of engineers through European mobility programmes is dependent on the close alignment of pre and post higher education quality standards. While UKSPEC and EUR-ACE are almost in harmony (see Figure 2), the output criteria of the two standards follow slight different definitions.

Figure 2 – UKSPEC vs EUR-ACE framework of standards for the accreditation of engineering programmes

EUR-ACE emphasises appropriate methods to conduct research while UKSPEC has a focus on knowledge and understanding of commercial, economic context of engineering and relevant legal requirements governing engineering activities. The packaging of the inner definitions of each criteria although not strictly the same has the same overall effect which end customers and the public in general can trust and would expect from a framework of quality labels that can enable the employability and mobility of engineering practitioners. One could almost assume that EUR-ACE is more accommodating of level 8 qualifications where UKSPEC fall short of this standard.

We have to bear in mind that for a UK aspiring engineer to qualify with a professional title such as C.Eng., the UKSPEC is just a form of accreditation of first and second degree cycles. Assessed professional development experience of the competence and commitment standards for Chartered Engineers under five mandatory headings is also required. The C.Eng. encompass using a combination of general and specialist engineering knowledge and understanding to optimise the application of existing and emerging technology; apply appropriate theoretical and practical methods to the analysis and solution of engineering problems; provide technical and commercial leadership; demonstrate effective interpersonal skills; demonstrate a personal commitment to professional standards, recognising obligations to society, the profession and the environment.

It is clear that in this ranking differentiation of the competency of an engineer that Europe may face the challenge of harmonising criteria to fully promote mobility . After all a C.Eng title is clear evidence in support of lifelong learning that adds a protective layer to those wishing to recruit high calibre engineers based on their engineering practice and personal competencies.

The solution lies in continuing to respect the great diversity of engineering education within the European Higher Education area and to extend the quality labels to cover lifelong learning whether as part of a structured development programme or to acknowledge engineering experiences through engineering roles and responsibilities undertaken by engineering practitioners along their careers.

1. **Quality assurance of engineering programme accreditation under EUR-ACE**

The EUR-ACE is a system that recognises the equivalence of the standards and procedures of national accreditation agencies, e.g. Engineering Council, to those of the overarching EUR-ACE framework. The equivalence is denoted by the national agencies being authorised to award EUR-ACE labels to qualifications which the agencies have accredited.

The Engineering Council UK is able to offer EUR-ACE labels for any engineering programme which is currently in accreditation (First Bologna Cycle Label for bachelor degrees, Second Bologna Cycle Label for M.Eng. and MSc) in the UK. The label is valid for the current accreditation period, and can be renewed when a programme is re-accredited.

As a nominated accreditor of the Institution of Engineering and Technology I can comment authoritatively on the robust, extensive and intensive process that is for a Higher Education Institution to obtain either a UK-SPEC or EUR-ACE quality label. While a dissection of the individual criteria of the accreditation is beyond the scope of this review, it is worth citing the main accreditation headings and their scope.

The visit to an institution lasts two complete days with a team of typically four accreditors drawn from a mix of education and industry.

The accreditation process looks at the programmes aims and objectives and whether these follow a SMART (specific, measurable, attainable, relevant and time bound) rationale. The level of innovation of the programmes is also considered under this heading. Any outcomes from previous accreditation visits are checked with particular emphasis with the full compliance with previous accreditation action plans imposed on the institution.

The endoscopy of the programmes is analysed from the UKSPEC and EUR-ACE framework perspectives, thus considering the criteria presented in Figure 2. Examination papers, continuous assessment practices, the balance of assessment and laboratory work are looked at in detail both in terms of the real samples presented by the institution and the quality control policies in place at the institution to ensure appropriateness of the work and internal and external scrutiny. The level and balance of group work and industrial influence, sponsorship and training on the programmes is monitored. Accreditors look for active industrial involvement and engineering curricula informed by research.

Another key section of the accreditation is the student admission progression and awards standards. Entry qualifications and student profiles of entry are statistically analysed and compared with exit awards gained by students.

One of the most critical criteria is that of student individual engineering project. To gain the status of an accredited degree, students must pass this at first attempt. Accreditors inspect the process that leads to a student undertaking a project, the level of tutor support and the quality of the engineering project report and engineering practice demonstrated by the student.

During the accreditation visit meetings with both staff and students take place to gather real views and correlate these with quality standards in place at the Higher Education Institution. The academic credentials of all academic and non-academic staff involved in programme delivery are inspected and considerations are made in terms of the student support that tutors provide. The resources and facilities for the teaching of each engineering programme are also looked at with a view that these must support the aims of the programme.

The visit is fully reported and action plans are drawn after the visit. The visit report identifies good practice as well as the necessary changes to alignment with the quality frameworks.

1. **Conclusion**

Academic accreditation forms the first step in the promotion of student mobility. The harmonising of the criteria between different national practices and complete definition to include lifelong learning and doctoral qualifications will no doubt create further reassurances both to the public and those in engineering recruitment that the present of EUR-ACE as an education quality label is robust and does no not endanger educational diversity but reinforces the status of engineering educational pedagogy. This way we promote employability and share the values of a world class European educational system.

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