Accreditation of Environmental Engineering Education at the School of Engineering, University of Firenze (Italy)

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Summary
In the wide framework of the knowledge triangle: education-innovation-research, the accreditation of environmental engineering education is here discussed. The application of the European Accreditation of Engineering Programmes EUR-ACE® model to the multidisciplinary first cycle degree in Civil, Building and Environmental Engineering and the more specific second cycle degree in Environmental Engineering, based on the European Credit Transfer System and in accordance with the Bologna Process, running at the School of Engineering, is discussed. Particularly, the critical issues to guarantee the quality and the status of environmental engineering graduates, in terms of applying knowledge capacities and technical innovative competences, according the Dublin Descriptors or the more engineering focused EUR-ACE® skill descriptors, and at local and global scale are preliminary examined and compared. The involvement of the professional working world in the definition of goals in skills, of typical expectations of achievements and abilities, and in general in comparing the teaching profile with the actual needs of the technical workforce, is also briefly described. The system for educating environmental engineers in knowledge and understanding, making informed judgments and choices, communication and learning skills, capacities to lifelong learning, is also considered.

Keywords - EUR-ACE® accreditation system, Bologna process, Dublin descriptors, European Credit Transfer System, Education-Innovation-Research.

1. Introduction
Environmental Engineers are technicians and professionals with specific skill on the sustainability of human presence in the environment. Environmental engineers must respond, in fact, to the challenges posed by a growing population and intensifying land-use pressure as well as maintaining or improving environmental quality and enhancing the utilization of resources (Caporali and Tuneski, 2013). Among other global dilemmas, to the environmental engineer it is often demanded to be able to develop systematic, innovative solutions in order to simultaneously meet water, food and energy needs while protecting natural resources, to build resilience to natural and technological disasters, to more accurately gauge countries' greenhouse gas emissions, with the difficult objective to establish a measure of environmental sustainability and to verify progress toward global goals or international commitments.
The globalization of challenges and problems to be faced, leads, in general, to the globalization of the engineering profession. In particular, since the environmental issues are without boundaries, the environmental engineer must have a multidisciplinary and interdisciplinary approach to adequately answer to the demand of technical innovative knowledge at global scale. The environmental engineers, more and more, are involved in international projects were the effective collaboration requires not only the capacity to communicate in a common technical language, but also the assurance of an adequate and common level of technical competences, knowledge and understanding. As a matter of fact, employability of engineering graduates is more than ever dependent on the internationally acceptability of the

skills and abilities they have acquired, particularly with reference to the environmental engineering graduates (Borri et al. 2012).
A good example of instrument for international recognition of qualifications, is the decentralized Europe-based accreditation system EUR-ACE®, which delineates the shared framework for outcome-based accreditation of engineering programmes as suitable "entry routes to the engineering profession" (Augusti, 2010; 2012), and provides a common quality label, the EUR-ACE® label, to programmes that meet a common basic set of standards (ENAEE, 2008).
In Italy, the accreditation body for Italian Engineering Programmes based on the EUR-ACE® model, that is authorized to award the EUR-ACE® label is QUACING - *Agenzia per la Certificazione della QUalità e l'ACcreditamento EUR-ACE dei Corsi di Studio in INGegneria*, the Agency for Quality Assurance & Accreditation of Engineering Programmes (www.quacing.it).
Besides, in Italy, the National Agency for University and Research Assessment ANVUR - *Agenzia Nazionale per la Valutazione dell'Università e della Ricerca*, has recently started to progressively promote the implementation of AVA - *Autovalutazione, Valutazione periodica e Accreditamento* (Self-assessment, periodic Assessment and Accreditation) system for Italian Higher Education Programmes (www.anvur.org). The AVA system is based on Italian National Regulations as well as on the European Standards and Guidelines for Quality Assurance in the European Higher Education Area (ENQA, 2009). Within the application of the AVA System, the Italian Ministry of University and Research (MIUR), has defined an Annual Single Form of the Degree Course, named SUA – *Scheda Unica Annuale del Corso di Studio*. The form includes an "Administrative" and a "Quality" part. The expected learning outcomes of the quality assessment are based on Dublin Descriptors (JQI, 2004).
The First – Bachelor and the Second – Master Cycles of Environmental Engineering Programmes, held at the University of Firenze, are participating to both the accreditation systems and are applying both the models. The quality and the status of environmental engineering graduates, and particularly the expected learning outcomes are assessed according the Dublin Descriptors as well as the more engineering focused EUR-ACE® skill descriptors. The two different accreditation systems and procedures, both still in progress, are briefly described and discussed here within the application to environmental engineering education, at University of Firenze, considering the accreditation strong means towards the education of competitive highly-qualified global environmental engineers.

2. Accreditation models

The EUR-ACE system, started in 2007, is a framework and accreditation system which provides a set of standards that identifies high quality engineering degree programmes in Europe and abroad. Within the Europe-based system EUR-ACE, a common quality label, the EUR-ACE® label, is awarded to engineering educational programmes that satisfy a common basic set of standards. The system is run by the European Network for Accreditation of Engineering Education (ENAEE) within the "EUR-ACE Framework Standards for the Accreditation of Engineering Programs" (ENAEE, 2008).
With reference to the ESG - European Standards and Guidelines for Quality Assurance in Higher Education (ENQA, 2009) adopted in 2005 within the "Bologna Process" by the Bergen Conference (2005), EUR-ACE® authorised agencies,

fulfilling appropriate Quality Assurance prescriptions, can award the EUR-ACE® label.

By definition, the EUR-ACE® label ensures the suitability of the accredited programme as entry route to the engineering profession, a sort of "pre-professional accreditation" (Augusti, 2010). The EUR-ACE system, in fact, incorporates the views and perspectives of the main interested parties (students and higher education institutions, employers and professional organizations as well as accreditation agencies). Engineers, physicians, architects and other professionals conduct activities which often intensely interact with society and affect the lives of the people. In order to assure that these actions and decisions are carried out safely and ethically, graduates must possess specific competences. To ensure that engineering education programmes produce graduates who can demonstrate satisfactory achievement of these competences, they are subject to accreditation by their professional body or another accreditation agency which carries out programme-based accreditation.

Engineering programmes that have been accredited by a EUR-ACE authorised agency can be awarded the EUR-ACE® label. Among the main characteristics of the EUR-ACE® label one can surely recall that it encompasses all engineering disciplines and profiles, it is internationally recognised and facilitates both academic and professional mobility. Moreover, it gives international value and recognition to engineering qualifications, and is awarded to programmes which fulfil the programme outcome standards as specified in the EUR-ACE Framework Standards. Finally it respects the great diversity of engineering education within the European Higher Education Area and has created a quality system for accredited engineering degree programmes that share common objectives and outlooks.

The EUR-ACE Framework Standards are valid for all branches of engineering and all profiles of study, and distinguish only between First and Second Cycle programmes, as defined in the European Qualification Frameworks, but are applicable also to "integrated programmes", i.e. programmes that lead directly to a Second (Master) Cycle engineering degree (Augusti, 2012).

The EUR-ACE accreditation process can be split in two different, but strictly correlated, phases: a self-assessment phase and an external evaluation (ENAEE, 2008). According to the accreditation model the self-assessment is implemented by an "Internal Quality Working Group", i.e. a group composed by academic, technical and support staff, students, selected within the school. As a result of the self-assessment activity, a self-assessment report is written by the Internal Quality Working Group in accordance with the guidelines for assessment and accreditation. In the implementation of the accreditation model a particular attention is voted to the description of the skills regarding the professional figure of engineer. In this case, it is fundamental to distinguish the differences, in terms of skills, among the three different learning levels of the "Bologna process", i.e. bachelor, master and PhD. The self-assessment report represents the starting point for the second phase of the accreditation process. On the basis of the content of the self-assessment report and the performance of the learning path, the second phase of external evaluation or peer review phase is organized through a site visit of an Accreditation Team. The objective of the site visit is to verify the compliance of the self-assessment activity and the contents of the report with the actual situation. The site visit should include meetings with the university management, academic and support staff members, current and former students, employers and with all the different stakeholders and interested parties; visits to facilities (libraries, laboratories, etc.); review of project

works, final documents etc. At the end of the site visit, during the closing meeting, feedback from the accreditation team is presented. The accreditation team then writes a report, often denoted as accreditation report. The fulfilment of each individual quality requirement is assessed, using a scale with at least the following three levels: 1) Acceptable; 2) Acceptable with prescriptions; 3) Unacceptable. The overall achievement of the requirements is also evaluated using a scale with at least three levels: 1) Accredited without reservation; 2) Accredited with prescriptions; 3) Not accredited. The university has the opportunity to check the report for factual errors (ENAEE, 2008). The final accreditation decision is taken by an accreditation institution, and may be valid for up to six years with surveillance in the time. After that time, re-accreditation is required.

In Italy, the QUACING Agency, the Agency for Quality Assurance & Accreditation of Engineering Programmes, is the accreditation body for Italian Engineering Programmes (www.quacing.it). QUACING is authorized to award the EUR-ACE® label and it is a full member of the European Network for Accreditation of Engineering Education (ENAEE). The agency was founded on 13 December 2010. Founding member organizations include: the Conference of Italian Engineering Deans (CoPI), CRUI (Conference of the Italian University Rectors) Foundation, CNI - Italian National Engineers' Council (which coordinates the Engineers' Provincial "Orders"), ANCE - National Association of Building Industries, Centro Ricerche FIAT S.p.A (the Research organization of FIAT), Finmeccanica S.p.A. (a National Mechanical Enterprise).

The Engineering programmes, through the Conference of Italian Engineering Deans – CoPI, has been concerned with accreditation since'90s, when a "National System for Accreditation of Engineering Study Programmes' (SINAI), that unfortunately remained at the stage of proposal, was elaborated. CoPI was one the founders of ESOEPE - European Standing Observatory for the Engineering Profession and Education (2000-2006), and one of the most active partners of the EUR-ACE and EUR-ACE IMPLEMENTATION projects. The general model behind the EUR-ACE Standards coincides, in fact, with the model behind the pilot projects of Higher Education evaluation 'Campus' and 'Campus*One*', run between 1995 and 2004 by CRUI with CoPI's collaboration.

In Italy, the university and research assessment, nowadays, is regulated by ANVUR - *Agenzia Nazionale per la Valutazione dell'Università e della Ricerca* (National Agency for University and Research Assessment). ANVUR (www.anvur.org) establishment was the object of a 2007 ministerial decree, but only recently the AVA – *Autovalutazione, Valutazione periodica, Accreditamento* (Self-assessment, Periodic Assessment and Accreditation) system for Italian Higher Education, has been implemented. The AVA system defines the set of ANVUR activities based on the national regulations, which provide the introduction of an initial and periodic accreditation system of degree courses and of higher education institutions, a periodic assessment of the quality, efficiency and results achieved by the universities and the strengthening of the system of self-assessment of the quality and effectiveness of teaching and research activities of universities. ANVUR has the duty of setting methodologies, criteria, parameters and indicators for the accreditation and periodic assessment. To ANVUR also concern the verification and monitoring of parameters and indicators for accreditation and periodic assessment for the annual resources allocation to universities. The fundamental elements of the AVA integrated system derived in large measure by the national legislation as well

as the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ENQA, 2009) approved by the European Ministers Conference in Bergen (2005), within the "Bologna Process".
The Higher Education Italian Institutions started to apply the AVA system last February 2013. In AVA system the expected learning outcomes for degree courses are described as general descriptors, i.e. their characteristics make them applicable to a large range of disciplines and profiles and they have to take into account the peculiarities of the national higher education system. Fundamental tool of AVA system is SUA - *Scheda Unica Annuale del Corso di Studio (*Annual Single Form of Degree Course). Within SUA, the expected learning outcomes of the quality assessment are based on Dublin Descriptors (JQI, 2004). Particularly, at this phase of the first implementation of AVA system, the expected learning outcomes are based on the first two Dublin Descriptors, "knowledge and understanding" and "applying knowledge and understanding". The Dublin Descriptors were elaborated after the European Ministries Conference of Prague (2001), by a group of experts which has named itself the Joint Quality Initiative (JQI) from different countries as a series of descriptors for the three cycles of the Bologna Process (JQI, 2004). The Dublin Descriptors offer generic statements of typical expectations of achievements and abilities associated with qualifications that represent the end of each of the Bologna cycle. They are not meant to be prescriptive; they do not represent threshold or minimum requirements and they are not exhaustive; similar or equivalent characteristics may be added or substituted. The descriptors seek to identify the nature of the whole qualification. They consist of a set of criteria, formulated in terms of competence levels, which enables to distinguish in a broad and general manner between the different cycles. The following five sets of criteria are distinguished: i) Knowledge and understanding; ii) Applying knowledge and understanding; iii) Making judgements; iv) Communication skills; v) Learning skills.
The development of the EUR-ACE® Programme Outcomes has been informed also by the Dublin Descriptors. Particularly, the EUR-ACE framework standards have identified six categories of learning outcomes: i) Knowledge and understanding; ii) Engineering analysis; iii) Engineering design; iv) Investigations; v) Engineering practice; vi) transferable skills. In comparison with the Dublin Descriptors, the six EURACE Learning outcomes focus on aspects related to Engineering analysis, design and practice.
While elaborating the self - assessment report of the EUR-ACE Accreditation System for the environmental engineering degree courses, the engineering-oriented outcomes have been analysed. A comparison between Dublin Descriptors and the EURACE Learning outcomes has been elaborated (Table 1).

3. Environmental Engineering Education at the University of Firenze (Italy)

The School of Engineering of the University of Firenze offers two degree courses in Environmental Engineering: the multidisciplinary first cycle degree in Civil, Building and Environmental Engineering and the more specific second cycle degree in Environmental Engineering. The First Cycle Degree – FCD course in Civil, Building and Environmental Engineering was introduced in the year 2012/2013 as transformation and continuation of three exiting first cycle degree courses: "Civil Engineering", "Building Engineering", and "Environmental, Resources and Territory Engineering".

Table 1. Learning Outcomes within the EUR-ACE® model and Dublin Descriptors

EUR-ACE Learning Outcomes	DUBLIN DESCRIPTORS
1. Knowledge and Understanding	
Knowledge and understanding of the scientific and mathematical principles underlying their branch of engineering	Knowledge and understanding
A systematic understanding of the key aspects and concepts of their branch of engineering	Knowledge and understanding
Coherent knowledge of their branch of engineering including some at the forefront of the branch	Knowledge and understanding
Awareness of the wider multidisciplinary context of engineering.	Knowledge and understanding
2 Engineering Analysis	
The ability to apply their knowledge and understanding to identify, formulate and solve engineering problems using established methods	Applying knowledge and understanding
The ability to apply their knowledge and understanding to analyse engineering products, processes and methods	Applying knowledge and understanding
The ability to select and apply relevant analytic and modelling methods.	Making judgements
3. Engineering Design	
The ability to apply their knowledge and understanding to develop and realise designs to meet defined and specified requirements	Making judgements
An understanding of design methodologies, and an ability to use them	Applying knowledge and understanding
4. Investigations	
The ability to conduct searches of literature, and to use data bases and other sources of information	Learning skills
The ability to design and conduct appropriate experiments, interpret the data and draw	Learning skills
Workshop and laboratory skills	Learning skills
5.Engineering Practice	
The ability to select and use appropriate equipment, tools and methods	Applying knowledge and understanding
The ability to combine theory and practice to solve engineering problems	Applying knowledge and understanding
An understanding of applicable techniques and methods, and of their limitations	Applying knowledge and understanding
An awareness of the non-technical implications of engineering practice	Making judgements
6.Transferableskills	
Function effectively as an individual and as a member of a team	Communication skills
Use diverse methods to communicate effectively with the engineering community and with society at large	Communication skills
Demonstrate awareness of the health, safety and legal issues and responsibilities of engineering practice, the impact of engineering solutions in a societal and environmental context, and commit to professional ethics, responsibilities and norms of engineering practice	Communication skills
Demonstrate an awareness of project management and business practices, such as risk and change management, and understand their limitations	Communication skills
Recognise the need for, and have the ability to engage in independent, life-long learning	Knowledge and understanding

The tradition of Civil Engineering at the University of Firenze dates back to 1970s, to the 1990s for Environmental Engineering and since 2000 for Building Engineering. The FCD has as main aim the education of technicians with a suitable basic scientific competences and understandings of methodologies and technical-specific skills of Civil, Building and Environmental Engineering. The degree course refers to four types of branches: Structures, Infrastructures, Building

and Environment. Every branch corresponds to a specific educational path in which professional competences are developed starting and continuing a common core basis. In the academic year 2012/13 only the 1st year of the programme has been activated, the 2nd year will be activated in 2013/14, while the 3rd in 2014/15.
The Second Cycle Degree – SCD course in Environmental Engineering has been activated in the academic year 2009/10, replacing the SCD based on a previous Ministerial Decree (DM 509/99), based in turn, since academic year 2000/2001, on the experience of the single integrated degree course of five year in Environmental Engineering. The SCD aims at educating high-level professionals that have not only an advanced knowledge of general environmental and territory engineering methods and contents applied to environmental protection and control but also scientific skills on analytic and numerical modelling. In addition economical and regulatory aspects are also present allowing a cultural/technical growth and capabilities for responsibility assumption.
In February 2012, the School of Engineering of the University of Firenze has decided to propose the two degree courses for the International Accreditation using the EUR-ACE® Framework Standards (ENAEE, 2008). As required, the two courses identified the Internal Quality Working Group, named GAV - *Gruppo di* Autovalutazione (Self-Assessment Group). The Internal Quality Working Group has completed the two self-assessment reports last February 2013 (GAV, 2013). The site visit for the external evaluation or peer review phase will be performed by QUACING Agency within the year 2013. The self-assessments report, among all data on the degree courses, the data about graduated students, the efficiency of their learning processes and the description of all course activities, has carried out a comparison between the Dublin Descriptors and the EURACE Learning Outcomes, in order to identify the EURACE required learning outcomes and the degree courses learning outcomes. For each category of the six ones of EURACE model, outcome criteria for FCD and SCD programmes' graduates have been established. Only the criteria to assess the needs, objectives and outcomes are briefly discussed here, in terms of "needs of the interested parties", "educational objectives" and "programme outcomes".

3.1 Needs of interested parties and career opportunities

The educational needs of the interested parties are analysed with reference to the professional working world as well as the career opportunities. For both the programmes (FCD and SCD), the consultations has involved the main subjects representative of the world of production, services and professions, i.e. "Order" of Engineers of the provinces of Firenze and Prato, industrial and handcraft associations, production companies and service providers, territorial government subjects such as Tuscany Region, Province of Firenze, Prato and Pistoia, ARPAT - *Agenzia Regionale per la Protezione Ambientale della Toscana* (Regional Agency of Environment Protection of Tuscany Region), Arno River Basin Authority, local land reclamation consortia, managing of water resources bodies, associations of professionals. The consultation meetings has been carried out through the instrument of the Steering Committee (*Comitato di Indirizzo)*, consisting of a representative for each of the interested parties. Within the consultations, the career opportunities are also evaluated together with the needed professional skills. The carrier opportunities are differentiated for the first and second cycle graduates.

Career opportunities of the FCD graduate are mainly as professionals or in enterprises, public and private agencies in the field of planning, design, implementation and management of structures, monitoring systems for environment and territory control, for soil protection, for waste, raw materials and environmental resources management, for environmental reclamation, for environmental impact assessment of plans and structures and in production processes.
The post-graduate SCD typical professional areas are the innovation as well as the development of advanced design, planning, and complex systems management; as professionals, as well as in manufacturing or services enterprises, or in the public administration. The graduates can be employed in enterprises, public or private agencies, professional consulting companies providing design, planning, realization and management of structures and monitoring systems for environment and territory, soil protection, waste, raw material and environmental, management of geological and energy resources; for environmental impact assessment of plans and structures.
As far as the career opportunities is concerned a survey (Borri et al., 2012) on the graduates' opinion on the level of training in the different technical and non-technical areas, comparing the teaching profile with the actual needs of the professional working environments has also been carried out as preliminary activity to the EUR-ACE accreditation of two programmes.

3.2 Environmental engineering education objectives and programme outcomes

The objectives and the learning outcome of the environmental engineering programmes are briefly discussed here with reference to the AVA system, as it is the more recent one and in its preliminary application it is concentrate on these aspects. As far as the FCD is concerned, while the basic knowledge is developed in common in the three branches, the differentiation among the branches is within the characteristic skills and integrative knowledge (Table 2).

Table 2. Learning outcomes of the FCD programme in Civil, Building and Environment Engineering with reference to the Environment branch.

DISCIPLINES & ACTIVITIES	knowledge and understanding	applying knowledge and understanding
Basic Knowledge	Sharing a reference language	To interpret and to solve typical issues of environmental engineering.
Mathematics, Informatics and Statistics		
Chemistry & Physics		
Characteristic Skills	Representation tools; principles of fluids, solids, soil, and structural mechanics	To represent, to analyse and to solve typical issues of environmental engineering; to collaborate and coordinate the activities with industry experts; to organize and to manage production activities; lifelong learning development particularly related to technology innovation.
Civil Engineering		
Environment and Territory Engineering		
Security, Civil, Environmental and Territory Protection		
Integrative Knowledge	Main technological aspects of the use of materials; main elements of the representation of computational graphic; safety and quality management in industry	Monitoring and control of: quality management systems; the various aspects of the industrial risk.

Particularly, the Environmental branch is focused on the aspects related to geology and geomorphology; expertise in environmental and territory engineering (i.e. issues and techniques related to pollution, waste treatment, water protection); subjects related to hydrology and hydraulic engineering; criteria for energy and environmental evaluation of buildings and electrical systems for the environment.
The characteristic skills and integrative knowledge of the SCD in Environmental Engineering are developed within the first year of the learning programme as completion of the FCD programme as well as with the activation of specific programmes. Further characterizations and specific knowledge of the individual study programme concern with elective courses and project works of the student (Table 3).
In both the cycles, knowledge and understanding are developed through the use of traditional forms of teaching (lectures, practice exercises, etc.). Applying knowledge and understanding concern with practice exercises in classroom or laboratory, both individual and in groups. The procedures to assess the actual achievement of educational objectives are done through exams that can be written, oral or the mix of the two, at the end or during the lectures period (i.e. intermediate tests).
Where provided, the assessment can concern also the evaluation of project works e specific laboratory reports, particularly, as far as is concerned with "applying knowledge and understanding"of the integrative disciplines.

Table 3. Learning outcomes of the SCD programme in Environmental Engineering.

DISCIPLINES & ACTIVITIES	knowledge and understanding	applying knowledge and understanding
Characteristic Skills for Environmental Engineering	• Territory and environment protection. • Plants and systems of environmental quality and energy production. • Environmental risk management	To identify, to formulate and to solve complex problems in innovative ways that may require an interdisciplinary approach; to design and to manage complex environmental systems and processes.
Integrative Knowledge	Specific and transversal knowledge also from the scientific and theoretical point of view	Enhancement of the capacity to interpret, to characterize and to solve complex engineering problems that require a typical interdisciplinary approach.

4. Conclusive remarks

The Environmental Engineering Education at University of Firenze, is described with reference to the application of the EUR-ACE® model and ANVUR – AVA system. The needs of interested parties and career opportunities resulting by the consultation with the working word and a survey on the graduates opinion has been used for the definition of the objectives and the learning outcomes of the two environmental engineering programmes. The differences of the two cycles are underlined on the basis of learning outcomes related to "knowledge and understanding" and "applying knowledge and understanding". The importance of the accreditation to guarantee the quality and the status of environmental engineering graduates, particularly in terms of applying knowledge capacities and innovative interdisciplinary competences is underlined throughout the paper.

References

Augusti G, **EUR-ACE® A common European quality label for accredited Engineering Programmes**, Proceedings of the International Conference on Engineering education ICEE, Gliwice, Poland, July 18 – 22, 2010.

Augusti G, **Quality and Accreditation in Engineering Education in Europe**. Proceedings of the International Symposium on Innovation and Quality in Engineering Education, 21:32, ISBN 978-84-695-3891-3, Valladolid, Spain, April 26 – 28, 2012.

Borri C., Manfrida G., Catelani M., Guberti E., Betti M. **Focusing the Gap Between Teaching Profile and Professional Skills**, Proceedings of the 1st ENAEE Conference: EUR-ACE® The European Quality Label for Engineering Degree Programmes Experiences and Perspectives, Porto, Portugal, November 12-13, 2012. Retrieved from http://www.enaee.eu/1st-enaee-annual-conference.

Caporali E. and Tuneski A., **Environmental engineering curricula development,** Proceedings of the 41th SEFI conference, Lueven, Belgium, September 16-20, 2013 (in press).

ENAEE - European Network for the Accreditation of Engineering Education, **EUR-ACE Framework Standards for the Accreditation of Engineering Programmes**, 2008. Retrieved from www.enaee.eu.

ENQA – European Association for Quality Assurance, **European Standards and Guidelines for Quality Assurance in the European Higher Education Area**, 2009. Retrieved from http://www.enqa.eu.

European Ministers in charge of Higher Education**. Towards the European Higher Education Area**. Communiqué of the meeting of in Prague, May 19th 2001. Retrieved from ec.europa.eu/education.

European Ministers Responsible for Higher Education. **The European Higher Education Area - Achieving the Goals**, Communiqué of the Conference of Bergen, 19-20 May, 2005. Retrieved from ec.europa.eu/education.

GAV – Gruppo di AutoValutazione. **Rapporto di Autovalutazione. Corso di Laurea in Ingegneria Civile, Edile e Ambientale / Corso di Laurea Magistrale in Ingegneria per la Tutela dell'Ambiente e del Territorio**, 2013. Retrieved from http://www.ing.unifi.it/clinat/CMpro-v-p-96.html.

JQI - Joint Quality Initiative informal group. **Shared 'Dublin' descriptors for Short Cycle, First Cycle, Second Cycle and Third Cycle Awards.** JQI meeting, Dublin, 18 October, 2004. Retrieved from archive.ehea.info.

Appendix: principal acronyms used in the paper

ANVUR	Italian National Agency for University and Research Assessment
AVA	Self-assessment, periodic assessment and accreditation
CRUI	Conference of the Italian University Rectors
ENAEE	European Network for Accreditation of Engineering Education
ENQA	European Association for Quality Assurance
ESG	European Standards and Guidelines for Quality Assurance in Higher Education
EUR-ACE	European Accreditation of Engineering Programmes
FCD	First Cycle Degree
GAV	Internal Quality Working Group
JQI	Joint Quality Initiative informal group
RAV	Self-Assessment Report
QUACING	Italian Agency for QA and EUR-ACE accreditation of engineering programmes
SCD	Second Cycle Degree
SUA	Scheda Unica Annuale (Annual Single Form)