ALFA MIRROR Project

Development of a reference model for comparison and recognition of engineering programmes

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Final Report

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Torino, Italy, 2010/2011

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Tiziana Cianni and **Nathalie Vacchiano** of Politecnico di Torino, have taken initiatives for the smooth running of the project.

With great sense of responsibility **Tiziana Cianni** has taken great care in revising the huge material provided by participants to edit this final report. To her heartfelt thanks.

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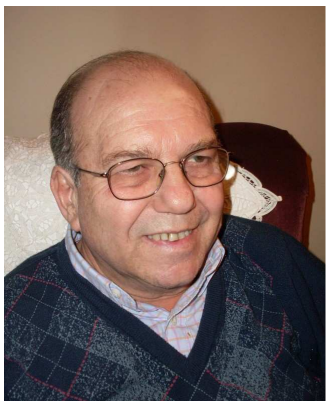

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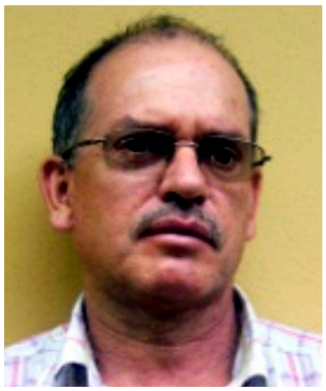

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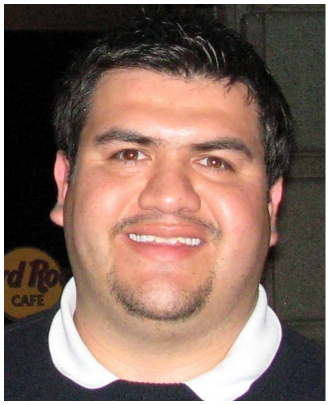

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Nominated Director of the School for three consecutive three-year terms, 1984 to 1990, again three consecutive three-year terms (1993-2002). In 2002 named Dean by the members of the Faculty of Engineering, again in 2005 and 2008 until today.

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Since 1993 Executive Director of Association Columbus, linking European and Latin American universities, promoting international co-operation and institutional development (member universities participate in regional development, i.e. incubators and SME's support).

Founding Director of Istituto Superiore "Mario Boella" for Information & Communication Technologies (Turin, Italy) in 1999-2001. He collaborates with the Torino Wireless Foundation, which promotes the development of the Piemontese ICT District (R+D, acceleration of enterprises and risk capital development).

Columbus and Torino Wireless, with other Piemontese institutions, are launching the Turin Euro-Latin American Forum for knowledge-based regional development (www.forumtorino.org).

Prof. Edmilson Santos de Lima, Centro de Tecnologia e Geociências, Universidade Federal de Pernambuco, Brazil – delima@ufpe.br

Geology Degree in 1977, PhD Degree in 1986 from UCLA. From 1989, Professor Geology at Universidade Federal de Pernambuco. Author of over 100 papers on various subjects in geology and environmental geology.

Director of the Centro de Tecnologia e Geociências da Universidade Federal de Pernambuco (2004-2008), reelected for a second term (2008-2012). Vice-Rector Substitute (2006-2010).

Research Fellow from the Brazilian Research Council, Member or leader of national (CNPq, FACEPE) and of international projects (ALFA-MIRROR, EXCEED-DAAD, CAPES COFECUB).

Prof. Felipe Tirado Díaz, Universidad de Talca, Chile – ftirado@utalca.cl

Mechanical Engineer , Universidad Técnica del Estado, Santiago, Chile (1977), Master of Environment, Environment Advisor Specialisation Energy Management, Univesity of de Twente, Netherlands (2001-2002). Professor in the Departament of Industrial Tecnology since 1977 in Heat Technology, Energy and Environment. Research Areas: Primary Sources of Energy (conventional and unconventional), Energy Management, Energy Saving and Efficiency.

Director of School of Mechanical Engineering (1990 – 2001) and (2003 – 2007).

Participation in the redesign of professional based on Competencies in the Mechanical Engineering Program, Universidad de Talca.

Director of Curriculum Management Unit of the University since 2008.

Prof. Ernesto A. Urquieta-González, Federal University of São Carlos – UFSCar, Brazil – urquieta@ufscar.br

1974: Chem. Eng. Degree; 1975-1983: Engineer at Project and Process Companies; 1987: MSc. in Chem. Eng.; 1992: DSc. in Science and Materials Eng. From 1993 Professor at Department and Post-Graduation Program of Chem. Eng.; Since 2003, Director of the Center of Exact Sciences and Technology. Since 1993, Researcher in Chem. Process and Catalysis. Coordinator of projects supported of Brazilian Agencies and Petrobras. Nowadays coordinates the creation of the Center on Process and Advanced Materials for Energy and Petroleum with 3600 m2 of Lab areas. 2009: Winner of Petrobras Prize on Environmental Preservation Technology. Author of more than 40 papers on Chem. Eng. and Catalysis and more than 120 works in National and International Congresses on Materials and Catalysis.

Prof. Dr Juan Manuel Vélez Restrepo, Universidad Nacional de Colombia, Medellín Campus – jmvelez@unal.edu.co

Mechanical Engineering Degree in 1983. Master Eng in 1991 and PhD in 1997 of the Sao Paulo University, Brazil.

From 1985 Professor to the Materials Science an engineering, Phase Transformation of Metals and Alloys and Tribology courses at the School of Mines, National University of Colombia in the Medellín Campus.

Director of Materials Engineering Department, 2003; Associated Dean for Research 2002- 2003; Dean of School of Mines 2006 – 2010. Leader of the Materials Science and Technology Research group.

Director of Leonardo da Vinci project: scientific and technological literacy and innovation in learning. National University of Colombia in the Medellín Campus.

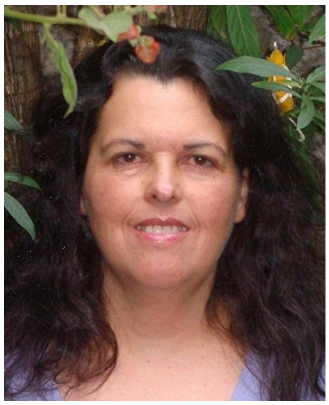
Prof. Gumersindo Verdú Martín, Universidad Politécnica de Valencia, Spain – gverdu@iqn.upv.es

Industrial Eng. degree in 1982. Ph. D. in Ind. Eng. in 1985. From 1994 Professor to the Chair of Nuclear Engineering.

Vice-Rector for International Affairs from 2005 to 2009.

Director of the Department of Chemical and Nuclear Engineering from 1997 to 2004.

Director of the Master degree “Industrial safety and environment” from 2006. Currently, the main research areas are: “medical physics”, “nuclear safety” and “radiations”.



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BSc in Chem. Eng. and MSc in Food Eng., Campinas State Univ. (1985 and 1992); PhD in Chem. Eng., Technical University of Denmark (1998). From 1990, professor at Chem. Eng. Dept., UFSCar.

Leader of the Chem. Eng. Tutoring Education Program (2000 – 2005) and Coordinator of the Chem. Eng. Undergr. Course (2006 – 2008). Assessor of the Undergraduation Studies Pro-rectory since 2004.

Research interest focused on Biochemical Engineering applied mainly to vaccines production, rE. coli high cell density cultivations and 2nd generation ethanol production. Over 50 works published as conference papers, articles and book chapters. Supervision of research initiation (16), MSc (8) and PhD (6) students.

Prof. Jorge Zegarra Pellanne, Pontificia Universidad Católica del Perú (PUCP), Perú – jorge.zegarra@pucp.edu.pe

Civil engineer (1983) from the PUCP, Master of Sciences (1991) from Imperial College of Science and Technology (University of London).

From 1985, full time Professor in the Department of Engineering, in Geotechnical Engineering and Strength of Materials courses of the PUCP; from 1998 to now, Principal Professor. Head of the Soil Mechanics Laboratory and Coordinator of Geotechnical Area (1994-2000), Coordinator of Civil Engineering Career (1996-2000), Director for Academic Affairs of the University (1999 to now).

Professor on the Postgraduate program of the School of Geological, Mining, Metallurgical and Geographical Engineering at Universidad Nacional Mayor de San Marcos (2008-2009).

Executive Summary (D. Samoilovich)

A EU- LA collaborative initiative by 18 universities and 2 networks

- During 3 years, with the support of the European Union (Alfa Program), they developed the **MIRROR- Q.A. FRAMEWORK** .
- Areas of application
  - Mechanical Engineering.
  - Chemical Engineering .
  - Electronic & Telecomunications Engineering.

A concrete contribution to the EULAC H. E. Common Space in engineering

All Partners

- Take into account the recent trends on curricular design and evaluation of academic programs.
- Capitalize on the convergence between curricula impelled by the Bologna process and on subregional integration processes in Latin America (e.g. Mercosur)

The MIRROR- Q.A. FRAMEWORK has been developed in clear-cut steps

Evaluation criteria have been agreed upon in order to evaluate

1. Learning outcomes (knowledge and skills obtained by the students)
2. The coherence of those outcomes with the professional roles to be exercised and the related competences.
3. The key processes of curricular design, implementation and review.

- A common language to express these criteria have been also agreed.
- The documentary evidence for each criterion have been identified.
- The criteria have been integrated in a reference model for comparison and, eventually, evaluation/accreditation of curricula.

Main elements of the MIRROR- Q.A. FRAMEWORK

- Evidence that the Programme design takes into account the requirements from the relevant stakeholders.
- Evidence that the Programme exposes students to an appropriate learning environment, with up-to-date equipment;
- Evidence that the Programme appropriately certifies that Learning Outcomes have been reached (how the exams have a certifying value)

The MIRROR- Q.A. FRAMEWORK has been validated experimentally

- It has been developed at 17 participant institutions from Argentina, Brazil, Chile, Colombia, Costa Rica, Germany, Italy, Mexico, Peru, Portugal, & Spain.
- The resulting applications have been reviewed by two external peers.
- Subsequent improvements to the model have been adopted.

Emerging outcomes

- A reflection of the participant academic units on the teaching-learning processes and the outcomes reached by the graduates have been clearly stimulated
- Proposals for content and processes improvements have been identified and implemented.
- Internal quality assurance procedures have been improved.

- Participating institutions can better communicate their academic offer.

Additional benefits:

- Agreement for studies recognition are now better supported.
- Student mobility between partner institutions is facilitated.

The experience is available in a reference document

The Final Report will include:

- the validated **Q.A. FRAMEWORK**,
- the bases for its application to other programs,
- a review of "good practices" for each criterion.

For the first time different key elements are combined in one single framework

- Description of quality assurance procedures,
- Communication with stakeholders,
- Communication with students,
- Communication with evaluators and auditors,

The MIRROR- Q.A. FRAMEWORK supports internal QA procedures & accreditation processes

It provides the core information of any self evaluation.

Value added:

- Synthetic, simple, easy to complete (no cumbersome, heavy paper work).
- Flexible: it has been tested in several different national and institutional contexts.
- A powerful tool to organize the available information (… and detect major gaps!).
- Relies in ICT.
- Sustainable: it collects the minimum sets of information, being at the same time a solid basis for internal quality assurance.

Extracts from the "FORMULARIO DE CANDIDATURA"

Título del proyecto

Desarrollo de un modelo de referencia para intercomparación y reconocimiento de carreras de ingeniería.

Palabras clave

Evaluación internacional comparada, reconocimiento de programas de estudio, resultados de aprendizaje, renovación curricular.

Duración del Proyecto

24 meses.

Objetivos del Proyecto

Desarrollar y aplicar un modelo que permita la comparación entre **resultados** y **procesos clave** de programas de estudio en el área de las ingenierías, utilizando criterios previamente acordados, a fin de estimular un reconocimiento de los programas y una reflex1on sobre la oferta académica entre las instituciones participantes.

Para asegurar su aplicabilidad y sostenibilidad, el modelo resultante será validado a través de su implementación en una variedad de contextos representada por los programas académicos de las instituciones miembros de la red.

Objetivos específicos

- Desarrollar criterios para la evaluación 1) de resultados de aprendizaje, 2) de la coherencia de esos resultados con los roles profesionales que se desea alcanzar y 3) de los procesos clave de diseño, implementación y revisión curricular.
- Expresar estos criterios a través un lenguaje común consensuado.
- Identificar la evidencia documental del cumplimiento de cada criterio.
- Integrar estos criterios en un modelo de base para intercomparación y, eventualmente, evaluación/acreditación de programas de estudio.
- Validar experimentalmente el modelo en las instituciones participantes.
- Estimular una reflexión sobre procesos de enseñanza/aprendizaje y resultados alcanzados por sus egresados.

Grupos objetivo del Proyecto

Beneficiarios directos

- Directivos universitarios con un interés en los objetivos, métodos y resultados de los programas de formación de ingenieros (primero y segundo ciclo o ciclo único), en particular vicerrectores académicos y responsables de cursos, departamentos y facultades en carreras de Ingeniería Electrónica, Mecánica y Química.

Beneficiarios indirectos

- Responsables gubernamentales: se benefician con un instrumento útil para el reconocimiento de diplomas, mecanismos de mejora de la calidad y desarrollo de sistemas transnacionales de evaluación.
- Estudiantes: se benefician con una mejora de los programas, mayores oportunidades de movilidad y mayor transparencia en la descripción de los programas de estudio.

Descripción general del Proyecto

La idea central del proyecto MIRROR es promover un proceso de evaluación comparada entre carreras de grado de ingeniería basado en criterios reconocidos como esenciales para caracterizar un programa académico y evaluar su calidad.

No existe una definición simple de calidad educativa en una carrera universitaria. Los criterios varían de acuerdo al enfoque y a las disciplinas.

Las universidades que integran la red conocen y valoran experiencias anteriores en el área de la evaluación comparada, con particular énfasis en los resultados del aprendizaje, tales como el proyecto de "Evaluación Internacional comparativa" desarrollado por el Danish Evaluation Institute (EVA) en el área de las Ciencias Agrarias; el proyecto "Transnational European Evaluation Project" (TEEP) en Historia, Veterinaria y Física; experiencias nacionales como el desarrollo de un modelo informativo por el Comitato Nazionale per la Valutazione del Sistema

Universitario (CNVSU) y el Proyecto "CampusOne" de la Conferencia de Rectores de las Universidades Italianas (CRUI); la experiencia de las agencias nacionales de evaluación (QAA, NVAO, CONEAU, CNA, CENEVAL, ...) y la acreditación de ingenierías en América Latina (MERCOSUR, Argentina, Brasil, Colombia, México, ...).

Esta red reconoce **cuatro factores centrales** esenciales para analizar y comparar los resultados y procesos clave de programas académicos:

1. **El nivel de cumplimiento de la carrera de grado con las expectativas de la sociedad** (profesionales, instituciones, empleadores potenciales o mercado de trabajo). Requiere la especificación de los principales **roles profesionales** de los graduados en un lenguaje comprensible para los actores externos, y la explicitación de **competencias** necesarias para cumplir con esos roles. (*A los fines de este proyecto, por competencias se entiende el conjunto de conocimientos y habilidades aplicadas en un contexto laboral*).

2. **El desarrollo del programa académico en congruencia con dichas expectativas en forma eficaz y sostenible**. Requiere que el programa de grado sea expresado en términos de resultados de aprendizaje, analizándolos a través de las competencias profesionales obtenidas por los egresados, teniendo en cuenta la duración de los estudios y la carga académica del estudiante expresada en créditos educativos.

3. **La efectiva disponibilidad de recursos que permiten crear un ambiente adecuado de aprendizaje**. Requiere verificar la disponibilidad de docentes, personal de apoyo, infraestructura y equipamientos adecuados.

4. **La verificación de resultados de aprendizaje alcanzados por el estudiante**. Requiere que los métodos de evaluación del estudiante permitan determinar si, y hasta dónde, los objetivos han sido transformados en resultados de aprendizaje.

El análisis de estos cuatro factores se efectuará a nivel de programa académico y de los cursos que lo componen:

- para cada programa académico, descripción de la estructura general y contenido, includendo el equilibrio entre los distintos elementos (cursos obligatorios, electivos, proyectos, capacitación práctica, etc.); equilibrio entre formación de base, formación especializada y habilidades; y equilibrio entre los métodos de enseñanza-aprendizaje.
- para cada curso, descripción de los prerrequisitos, objetivos, contenidos, metodología, horas presenciales y procedimientos de evaluación del estudiante.

Mientras que para el análisis de procesos es suficiente verificar su existencia y eficacia respecto a los objetivos perseguidos (fitness for purpose), limitándose por razones de economía a los

más significativos, el análisis de los resultados requiere de un consenso amplio sobre metas aceptables (fitness of purpose / benchmarks).

El trabajo se desarrollará en 4 fases:

- Desarrollo de la metodología y acuerdo sobre los criterios a utilizar para evaluar el diseño y la implementación de los programas de estudio; identificación del tipo de evidencia necesaria para evaluar su cumplimiento (**desarrollo del modelo de referencia**).
- Trabajo en cada institución para recopilar la información necesaria de acuerdo a criterios acordados (**dossier informativo**).
- Visitas externas recíprocas por parte de dos representantes de otras universidades de la red para verificar la consistencia de la información recopilada y la aplicabilidad del modelo; dicha visita culminará con un breve informe por parte de los pares externos en el que se establecerá si la información cumple o no con los criterios establecidos **(auditoría del dossier informativo**).
- Trabajo de puesta en común con conclusiones y recomendaciones para la mejora de los programas de estudio en las instituciones participantes y otras potencialmente interesadas (**validación del modelo**).

A través de esta información, se podrá llegar a un juicio informado concerniente a las metas y resultados del programa, facilitando así su reconocimiento académico y profesional. Esta información asegurará también que las calificaciones obtenidas por el estudiante sean comprensibles en otros contextos, haciendo más fácil su valoración y mejorando las posibilidades de empleo del graduado en su país y en el extranjero.

El modelo desarrollado estará disponible en la Web y su carácter sintético facilitará su aplicabilidad y sostenibilidad más allá de la duración del proyecto. El dossier informativo preparado sobre la base del modelo podrá ser compilado y actualizado en forma relativamente económica (en comparación con un proceso de autoevaluación), convirtiéndose así en un instrumento que facilite a las instituciones participantes la mejora de su calidad y – previa validación externa – una mayor transparencia y el reconocimiento de sus programas de estudio.

Valor añadido del Proyecto

Como resultado de esta experiencia, **las universidades participantes tendrán la oportunidad de**:

- Fomentar una confianza mutua que permita la **movilidad** de estudiantes y graduados.
- Sentar las bases para el **reconocimiento** de estudios y acuerdos de colaboración entre programas académicos (doble diploma, masters conjuntos, etc.).
- Desarrollar procesos de **renovación curricular** y mecanismos para la mejora de la calidad.
- Aplicar una **metodología e instrumentos innovadores** para analizar la relación entre los procesos de enseñanza-aprendizaje y los resultados obtenidos en un programa académico.
- Alcanzar mayor **visibilidad internacional**.
- Contribuir a la **construcción del Espacio Común** de educación superior UEALC en una disciplina estratégica.

Actividades a desarrollar y sus procedimientos

De acuerdo a lo explicado en la Descripción general del Proyecto … , el trabajo se desarrollará en 4 fases, lo cual implica que los miembros y/o el Comité de Orientación … se reúnan 4 veces a lo largo de los 24 meses que dura el proyecto. Las actividades realizas en cada reunión y entre cada una de ellas, se describen a continuación.

Primera reunión

- Desarrollo de la metodología y acuerdo sobre los criterios a utilizar para evaluar el diseño y la implementación de los programas de estudio; identificación del tipo de evidencia necesaria para evaluar su cumplimiento (**desarrollo del modelo de referencia**).
- Designación del Comité de Orientación.
- Preparación del plan de trabajo detallado.

Entre la primera y la segunda reunión:

- Trabajo en cada institución para recopilar la información necesaria de acuerdo a criterios acordados (**dossier informativo**).

Segunda reunión:

- Verificación preliminar del modelo de referencia.
- Organización de las visitas externas.

Entre la segunda y la tercera reunión:

- Visitas externas recíprocas por parte de dos representantes de otras universidades de la red para verificar la consistencia de la información recopilada y la aplicabilidad del modelo; dicha visita culminará con un breve informe por parte de los pares externos en el que se establecerá si la información cumple o no con los criterios establecidos **(auditoría del dossier informativo**).

Tercera reunión:

- Verificación final del modelo.
- Trabajo de puesta en común con conclusiones y recomendaciones para la mejora de los programas de estudio en las instituciones participantes y otras potencialmente interesadas (**validación del modelo**).
- Preparación del plan de difusión.
- Preparación de la documentación final de resultados (instrumentos, modelo de referencia, etc.).

Cuarta reunión (Sólo comité de orientación):

- Validación de la documentación y decisión sobre las acciones ulteriores de difusión.

English summary of the submitted project

Project Title
Development of a reference model for comparison and recognition of engineering Programmes.

Key words
International comparative evaluation, recognition of curricula, learning outcomes, curricular renovation.

Objectives of the network
The network has been organised based on previous bilateral and multilateral relations, from the expression of a will to collaborate in the development of a reference model for comparing academic programmes, using common criteria supported by sufficient evidence.

The participant universities:
- know and value previous experiences in the area of evaluation.
- take into account the recent trends on curricular design and evaluation of academic programmes
- wish to contribute to the construction of the EULAC (Europe, Latin America and the Caribbean) higher education Common Space in the area of engineering, starting from the convergence between curricula impelled by the Bologna process and processes of subregional integration in Latin America (e.g. Mercosur).

Objectives of the project
To develop and apply a model allowing the comparison between curricula's key outcomes and processes in the area of engineering, using previously agreed criteria, aiming at stimulating programme recognition and a reflection on the academic offers of participant institutions.

In order to assure its applicability and sustainability, the resulting model will be validated through its implementation in a variety of contexts represented by the different academic programmes of the network's member institutions.

Specific objectives
- To develop criteria for evaluating: 1) learning outcomes (knowledge and skills obtained by the students), 2) the coherence of those outcomes with the professional roles to be exercised 3) the key processes of curricular design, implementation and review.
- To express these criteria through a common agreed language.
- To identify the documentary evidence for each criterion.
- To integrate these criteria in a reference model for comparison and, eventually, evaluation/accreditation of the curricula.
- To validate the model experimentally by applying it at the participant institutions.
- To stimulate a reflection of the participant academic units on the teaching-learning processes and the outcomes reached by the graduates.

Expected results
- A validated reference model for comparing academic programmes
- An informative dossier, resulting from the application of the methodology to the academic programmes at each participant institution
- An innovative methodology and instruments, to analyse the relationship between the teaching-learning processes and the results obtained in an academic programme.

- Implementation proposals for academic and managerial improvement in Engineering.
- A contribution to the construction of the EULAC higher education Common Space in a strategic discipline.

The four development stages:

1. Development of the methodology and agreement about the criteria to evaluate the design and implementation of academic programmes; identification of the necessary evidence to evaluate their fulfilment (**development of the reference model**).
2. Work at each institution to collect the necessary information according to the agreed criteria (**informative dossier**).
3. Reciprocal external visits from two representatives of other universities participating in the network, to verify the consistency of the collected information and the applicability of the model. This visit will end with a brief report by the external peers, establishing if the information fulfils or not the established criteria (**informative dossier audit**).
4. Final work with conclusions and recommendations for the improvement of academic programmes within participant institutions and others potentially interested (**validation of the model**).

Through this process, an informed judgement concerning the degree programme's goals and outcomes will be reached, facilitating its academic and professional recognition. Such information will also ensure that the qualifications obtained by the student are comprehensible in other educational contexts, making them easier to appraise and improving graduates' employability in their home countries and abroad.

The developed model will be available on the Web and its synthetic character will facilitate its applicability and sustainability beyond the project duration. The informative dossier based on the model may be compiled and updated in a relatively economic way (compared to a self-evaluation process), becoming thus an enabler for the participant institutions to improve their quality and – via external validation – enabling wider transparency and recognition of their academic programmes.

Outline of the project (I. Mazòn)

Introduction

In the frame of the globalization of higher studies, one of the main tasks of the Bologna process for the European universities is to increase the attraction of international students.

Latin American universities need to build a space in this globalization process and want to participate more actively of it.

On both regions, most of the institutions want to modernize their curricula and the teaching and learning process, particularly on the engineering programs, mainly for their strategic impact on the social and economic development.

On this project the partners are working on engineering, an area of great interest for both regions. The purpose is that the academic authorities can obtain benefits of the experiences on curricular reforms and the constant improvement of quality programs existing now. To take advantage of the local, nationals or European mechanisms (VI Frame Program, Marie Curie Scholarships, ALFA, Alban,…), to obtain a better valorisation of the programs taken by the students and a simplification of the process for admission to other universities.

In this sense the institution included on the project has recognize the previous experiences on evaluation, taking in consideration the new tendencies on curricular and evaluation design of academic programs, and it wants to build an European and Latin American (EULA) common space for superior education on engineering, from the curricular convergence of the Bologna declaration an the regional and sub regional process on Latin America (Ex: MERCOSUR).

The criteria used to evaluate the programs are based on the following facts:

- Professional competencies: knowledge and learning outcomes obtained by the student.
- The coherency between the professional competencies and the roles of the professional exercise.
- The process of curricular design, implementation and review.

The partners want to develop a common language, identify the documented evidences that satisfy these criteria, integrate those criteria on a reference model for comparison purposes and eventually the evaluation/accreditation of curricula. They also want to validate the model experimentally by applying it to the partner institutions and stimulate the reflection among the partners about the process of learning and the competencies obtained by the graduates.

Other objectives of the project are to create academic collaboration agreements between the institutions, increase the mobility of students between the partner institutions and create reference documents with de model validated and the bases to be applied by other institutions.

The programs to be analysed are: Chemical Engineering, Mechanical Engineering and Electronics Engineering. Each institution has to choose one of those programs to collect the information requested by the model.

General description of the project

The central idea of the MIRROR project is to promote a comparative evaluation process between engineering degree programs based on a agreed criteria, which is essential to characterize an academic program and to evaluate its quality. There is no simple definition of quality in education. Criteria may vary according to the approaches and the disciplines. This network recognizes **four essential central factors** analyze and compare academic programs:

1. **The extent to which the degree program matches external expectations** (professionals, institutions, potential employers and labour market). It requires the specification of the main **professional roles** of the graduates in a language understandable to the stakeholders, and the statement of the necessary **competencies** to fulfil those roles. *(For the aims of this project, competencies are designed as a set of knowledge and skills applied in a work context).*
2. **The development of the academic program in congruence with those expectations in an efficient and sustainable form.** It requires the transcription of the degree programs in terms of learning outcomes, analyzing them through the professional competencies obtained by the graduates, taking into account the duration of studies and the academic workload expressed in terms of educational credits.
3. **The real availability of resources allowing the creation of an adequate learning environment.** It requires the verification of the faculty, administrative staff, infrastructure and equipment availability.
1. **The verification of learning outcomes achieved by the student.** It requires the specification of the assessment methods necessary to determine if and to what extent the educational goals have in fact been turned into learning outcomes.

The analysis of these four factors will be done at the academic program and course levels:

- For each academic program: description of the general structure and contents, including the balance between the different elements (compulsory or elective courses, projects, practical training, etc.); balance between basic contents, specialized contents and skills; and balance between teaching-learning methods.
- For each course: description of the prerequisites, objectives, contents, methodology, course hours and assessment procedures.

For the analysis of the processes it is enough to verify their existence and efficiency related to the desired objectives (fitness for purpose), limiting the number of them (to diminish costs) to the most significant ones. On the other hand, the results analysis requires a large consensus about what are considered to be acceptable values or standards (fitness for purpose/benchmarks).

The work was designed to follow four stages:

- Development of the methodology and agreement about the criteria to evaluate the design and implementation of academic programs; identification of the necessary evidence to evaluate their fulfilment (**development of the reference model**).
- Work at each institution to collect the necessary information according to the agreed criteria (**informative dossier**)
- Reciprocal external visits from two representatives of other universities participating in the network, to verify the consistency of the collected information and the applicability of the model. This visit will end with a brief **report by the external peers**,
- Establishing if the information fulfils or not the established criteria (**informative dossier audit**).
- Final work with conclusions and recommendations for the improvement of academic programs within participant institutions and others potentially interested (**validation of the model**).

Through this process, an informed judgement concerning the degree programs goals and outcomes will be reached, facilitating its academic and professional recognition. Such information will also ensure that the qualifications obtained by the student are comprehensible in other

educational contexts, making them easier to appraise and improving graduates employability in their home countries and abroad.

The model is designed to be available on the Web and its synthetic character will facilitate its applicability and sustainability beyond the project duration. The informative dossier based on the model may be compiled and updated in a relatively economic way (compared to a self-evaluation process), becoming thus an enabler for the participant institutions to improve their quality and via external validation - enabling wider transparency and recognition of their academic programs.

Background and perspectives of the MIRROR project (M. M. Gola)

Why Q.A. of higher education is a desirable objective

There is a great variety of engineer names, which multiply by the variety of profiles each can have. For certain professions the profile may be regulated, but the situation is so fluid that we have to accept innovation asking in exchange precise descriptions. Simultaneously along the lines of requirements coming both from "a) – outside the academia" and "b) – inside the academia". The same holds much in the same way for any other profession, it is not an exclusive feature of the engineering education.

A – Outside Academia.

- Which are the **professional roles** to which that particular engineer is being prepared when he still is a student?
- Which are the **functions** she/he will cover when at work, at least in her/his first five or ten years of career?
- Which are the key **competencies** which are typical of those roles / functions? (which means knowledge and skills used in a working context)

The Programme must be designed around those **roles / functions /competencies**, in order not to create a mismatch between exit outcomes and exit requirements.

It is difficult, and would be very risky, to believe that all the above can be defined without consultation with external stakeholders or without prospective studies from the employers' and professional side. **Self reference is lurking**!

Then the Programme must be able to fulfil its own prophecies.

The borderline between the world outside and the world inside the academy is quite fuzzy. There is no mechanic one-to-one relation between the tools we transmit to the student and the task she/he will be asked to solve.

B – Inside Academia

Then, to the best of our knowledge we have to make an hypothesis, and build subject specific **knowledge / understanding / skills / know-how** , plus transversal skills towards that aim.

This knowledge building has an **external effectiveness**: the capability of rapidly grasping those competencies which were taken as the far objective. This happens outside, and success will be checked only with a follow up of alumni performance over a certain time span.

But it has also an internal effectiveness (*not to be confused with efficiency, which tells us how much effort was necessary*): the single steps though which pieces of knowledge are gradually built. This is fully in the hands of ourselves, the professors i.e. the professionals who know how **Learning Outcomes** must be transmitted and, last but by not least, how to verify whether they were effectively reached by the students. (**student assessment or examination as Learning Outcome certification**).

This all what professional teaching is about. A first class university professor should be excellent in this professionalism, besides of course striving to be an excellent researcher with high level papers. Otherwise, why she/he does not move to a pure research institution?

This is were Quality Assurance of higher education comes in.

Let us remark that "**to assure** …" means "**to give confidence that** …"

Therefore "to assure" is largely dependent on the fact that each party is qualified and willing to discharge his/her job competently and on time.

Moreover, in our context "quality" means "satisfaction of explicit requirements".

The Mirror project was driven by a clear cut choice: Quality in simple language is2:

- **Specifying worthwhile learning goals**:
  drawing on contributions from stakeholders outside the university, the degree program must identify overall learning goals which will enable students to satisfy their further study and career aspirations.
- **Enabling the majority of students to achieve these goals:**
  the degree program must expose students to the learning experiences that will be most effective in helping them achieve stated goals.
- **It also involves establishing quality assurance procedures.**

Quality and Quality Assurance of Programmes must be viewed as part of an **international movement** which centres on **describing, developing, and certifying target competencies and learning outcomes**.

The Quality (and Quality Assurance - Q.A.) Framework developed within the ALFA Mirror Project was developed around such main ideas, or core principles.

More formally: a reasonable level of confidence in the quality of a degree program can be ensured if and only if a **Q. A.** Framework is deployed around the following **set of core principles** to be made **available in a public document**:

- the Programme must be clearly **designed** around **External Requirements and Target Competencies** which are in agreement with the needs of the employers and the labour market; such relations should be present already at the design phase, and not only (as it often happens) at the award stage or the final project
- the Programme must be **clearly implemented** with **up-to-date Learning Outcomes**, which are in agreement (content, amount, level) with the target competencies
- the Programme must expose the students to an **appropriate learning environment**, with **appropriate and state of the art equipment** (& laboratories, rooms, but also instructors, methods …)
- the Programme appropriately **certifies** that the **Learning Outcomes have been reached**; the exams have a true certifying value.

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[2] H3E, Position Paper on Quality and Quality Assurance, A proposal for a formalised procedure for achieving good quality teaching of engineering in European universities, (WG2, John Sparkes coord.), march 1999

Boundary conditions and perspectives to the Q. A. FRAMEWORK

(Internal) Quality Assurance comes well before any external Evaluation or Accreditation process.

It should make sure that a well behaved Programme is not born just short before an external evaluation or accreditation comes, neither that Quality Assurance consists only of inspections, audits and controls.

Rather, it must inform the degree Programme's day-to-day operations, becoming an open window on the institution. Therefore, the degree Programme must provide the outside world with a basic set of uniformly organized information that enables stakeholders to make informed judgments about the degree Programme's aims, methods and the learning environment provided to the student; helps orient prospective students, and facilitates second-party and third-party evaluation/accreditation.

Meeting these needs calls for an approach based on permanent monitoring: the Programme must be asked to produce and maintain a set of appropriate information.

Additional considerations stay behind the development of the "**MIRROR – Q.A. FRAMEWORK**" during the activity of the ALFA-Mirror Project group.

- To be truly effective, any systematic approach to quality assurance must thus be **compatible with the environment** to which it is applied.
- Its benefits must **outweigh the time, money and effort put into it**.
- Degree programs have always been rather loosely organized: alliances between fiercely independent actors driven by disparate motivations. Quality assurance measures can be effective only if they change or regulate these actors' conduct, **less by coercion than by suggestion and example**; by the kind of give and take that results in voluntary participation, a determination to get things done, a readiness to cooperate, a willingness to shoulder responsibility.
- Quality assurance programs involve a fairly complex administrative apparatus that collects and processes data and ensures compliance with organizational and regulatory requirements. **It is essential that these day-to-day tasks be handled by trained staff who can help the faculty accomplish its aims and relieve it of much of the burden involved**.
- Ensuring that the faculty understands what the quality assurance program is seeking to achieve is equally important. The message must be clear: **each faculty member must know precisely what he or she is expected to do**, and how it will contribute to enhancing the degree program's quality. This is not a question of appealing to the individual's good will, but of emphasizing that the real focus and pivot of quality assurance is the Programme.

It is worthwhile, at this point, to underline that the core principles adopted by ALFA-Mirror satisfy the ENQA Standards and Guidelines of 2005[3]:

checking that learning outcomes gained and assesses at school match the competences to be developed ⇒ **ENQA: development and publication of explicit intended learning outcomes; careful attention to curriculum and programme design and content**

- designing the Programme learning outcomes against external requirements (employers, labour market perspectives, society …) and properly define sets of competences that the degree holder will be required to exercise when at work ⇒ ENQA: regular feedback from employers, labour market representatives and other relevant organisations

[3] ENQA, Standards and Guidelines for Quality Assurance in the European Higher Education Area, Helsinki, 2005

- having procedures for the setting and checking of exam papers and for their distribution, for the invigilation of exams and for the marking and monitoring of students' responses, etc. ⇒ ENQA: Students should be assessed using published criteria, regulations and procedures which are applied consistently

It is also very interesting to see the new developments of a very important national agency such as the Dutch NVAO for the accreditation of Programmes (however, in line with NVAO criteria already applied in the Accreditation Framework started in 20034).

It examines the content and quality of the Programme, focussing on six questions all of them covered by the **MIRROR- Q.A. FRAMEWORK**:

1. What is the intention of the Programme?
2. With what curriculum?
3. With what staff?
4. With what facilities?
5. How does the programme intend to guarantee quality?
6. Are the objectives being achieved?

The "intention of the Programme" and "curriculum" are explored by NVAO along the following lines, which I consider to be the "core":

- Level and orientation are in line with the current requirements set by the occupational field and the discipline from an international perspective in terms of the programme content
- The curriculum has demonstrable links with current developments in the occupational field and the discipline
- The learning outcomes are adequately translated into the learning objectives of the curriculum. Students follow a course programme that is cohesive in terms of content.
- Interim and final exams, final projects and the way in which graduates function in practice or in subsequent education demonstrate what level has been realised. Exams and assessments are valid, reliable and clear to the students

It is evident that the development of the Mirror already at the time of submission, in fall 2004, adhered to the same principles, being at the same time a Quality Assurance Framework, i.e. a tool for Quality Assurance and Assessment of Engineering Education and an instrument for comparison and cross-validation of academic Programmes.

[4] NVAO, Accreditation Framework, The Netherlands ,14 February 2003, http://www.nvao.net/accreditation

The MIRROR project facts and deeds

As already stated, the ALFA "Mirror" Project aims at the development of a reference model for comparison and recognition of engineering programmes:
to develop and apply a model allowing the comparison between curricula's key outcomes and processes in the area of engineering, using previously agreed criteria, aiming at stimulating programme recognition and a reflection on the academic offers of participant institutions.

Specific objectives of the ALFA Mirror Project were:

- To develop criteria for evaluating: 1) learning outcomes (knowledge and skills obtained by the students), 2) the coherence of those outcomes with the professional roles to be exercised 3) the key processes of curricular design, implementation and review.
- To express these criteria through a common agreed language.
- To identify the documentary evidence for each criterion.
- To integrate these criteria in a reference model for comparison and, eventually, evaluation/accreditation of the curricula.
- To validate the model experimentally by applying it at the participant institutions.
- To stimulate a reflection of the participant academic units on the teaching-learning processes and the outcomes reached by the graduates.

In order to assure its applicability and sustainability, the resulting **MIRROR- Q.A. FRAMEWORK** was to be, and effectively it was, validated through its implementation in a variety of contexts represented by the different academic programmes of the network's member institutions.

The **MIRROR NETWORK** composition eventually stabilised on the following active participants:

Latin America

Argentina	Universidad Nacional de Mar del Plata	Chile	Universidad de Talca
Argentina	Universidad Nacional de San Juan	Colombia	Universidad Nacional de Colombia
Brazil	ABENGE, Associação Brasileira de Ensino de Engenharia	Costa Rica	Universidad de Costa Rica
Brazil	Universidade Federal de São Carlos	Mexico	Instituto Tecnológico y de Estudios Superiores de Monterrey
Brazil	Universidade Federal de Pernambuco	Mexico	Universidad Iberoamericana
Brazil	Universidade Estadual de Campinas – Unicamp	Peru	Pontificia Univers. Católica del Peru
Chile	Pontificia Univers. Católica de Valparaíso		

European Union

France	Association COLUMBUS Paris	Portugal	Universidade de Aveiro
Germany	Techn. Universität Braunschweig	Spain	Universidad Politécnica de Valencia
Italy	Politecnico di Torino		

The Mirror Project work has followed the four scheduled stages during the years 2007/2009:

- Development of the methodology and agreement about the criteria to evaluate the design and implementation of academic programs; identification of the necessary evidence to evaluate their fulfilment (development of the reference model)

  I Plenary Meeting in San José de Costa Rica, august 2007
- Work at each institution to collect the necessary information according to the agreed criteria (informative dossier); exchange of experience

  II Plenary Meeting in Madrid, march 2008

  III Plenary Meeting in Campinas, november 2008
- External visits from two representatives of other universities participating in the network, with the double purpose to verify the consistency of the collected information and the effective applicability of the model. This visit will has ended with a report by the external peers, establishing if the information fulfils or not the established criteria (informative dossier audit). January-March 2009 (Table 1 shows details of the visiting teams)
- Final work with conclusions and recommendations for the improvement of academic programs within participant institutions and others potentially interested (validation of the model). Revision and follow up activity after the IV meeting

  IV Meeting, Orientation Committee only, in Torino, June 2009
- Six months extension, project closure, final version of all Q.A. Frameworks, by **December 2009**.

Of course, preparatory work of the first two meeting was extremely valuable. It was the time were the core principles were discussed and adopted.

But the external visits proved to be **"the"** crucial factor for the success of the project.
It was the phase when participants were involved in two synergic ways: covering the double role of evaluated and evaluators. It was then the time when a really deep discussion developed, problems arose, each one had to compare the solution he/she had given to them and solutions proposed by others. These visits combined the efforts of three institutions: the one which was visited, and two others one from Latin America and one from Europe (Table 1).

Thanks to this self-reinforcing process of learning and exchange the project really gained momentum. This was, if necessary, a proof that Quality Assurance measures and how they are communicated rely on two catalysts for change:

- Open access: The very fact that documentation is freely available encourages a spirit of transparency. As a result, the organization can communicate itself more effectively.
- Clear-cut rules: people are inclined to give more careful thought to expectations that are clearly and appropriately expressed. This leads them to emulate the improvements they see around them, a process that openly accessible information helps spread.

Thanks to this, a collection of tested and discussed documents was made available to the **Orientation Committee** on the last meeting. Some revisions were further suggested by comparing proposals set forth by the different participants. It is predicted that by the conclusion of the project, due end of 2009, an result of average high value will be made available to participating institutions to help other Programmes go along the same lines.

Table 1 – Visited and visiting institutions in the external visits

University visited	Team from Europe provided by:	Team from Latin America provided by:
Universidad Nacional de Mar del Plata	Universidad Politécnica de Madrid	ABENGE
Universidad Nacional de San Juan	Universidad Politécnica de Madrid	Inst. Tecnol. y de Est. Sup. de Monterrey
Universidade Federal de São Carlos	Universidade de Aveiro	Universidad Nacional de Mar del Plata
Universidade Federal de Pernambuco	Universidade de Aveiro	Pontificia Universidad Católica de Valparaíso
Universidad Estadual de Campinas	Universidade de Aveiro	Universidad Nacional de Colombia
Pont. Univ. Católica de Valparaíso (Ing. Química)	Politecnico di Torino	Universidade Federal de São Carlos
Pont. Univ. Católica de Valparaíso (Ing. Electronica)	Politecnico di Torino	Universidad de Costa Rica
Universidad de Talca	Politecnico di Torino	Universidad Nacional de San Juan
Universidad Nacional de Colombia	Universidad Politécnica de Valencia	Universidad de Talca
Universidad de Costa Rica	Universidad Politécnica de Valencia	Instituto Tecnológico de Sonora
Inst. Tecnol. y de Est. Sup. de Monterrey	Techn. Universität Braunschweig	Universidad de Costa Rica
Universidad Iberoamericana	Techn. Universität Braunschweig	Universidad Estadual de Campinas
Instituto Tecnológico de Sonora	Techn. Universität Braunschweig	Pontificia Universidad Católica del Perú
Pontificia Universidad Católica del Perú	Universidad Politécnica de Valencia	Universidad Iberoamericana
Universidad Politécnica de Valencia	Universidade de Aveiro	Universidade Federal de Pernambuco
Universidade de Aveiro	Universidad Politécnica de Valencia	Universidade Federal de São Carlos
Politecnico di Torino	Techn. Universität Braunschweig	Pont. Univ. Católica de Valparaíso
Techn. Universität Braunschweig	Politecnico di Torino	Inst. Tecnol. y de Est. Sup. de Monterrey

Outcome: the populated tables of the MIRROR- Q.A. FRAMEWORK

Information is conveyed in Tables (compatible with screen spaces) organised as shown in Table 2:

- four key "aspects" of the evaluation are considered:
  A-Requirements and objectives,
  B-Teaching, learning and assessment,
  C-Learning resources,
  D-Monitoring, analysis, review
- each "aspect" is clarified through a certain number of "factors" separately indicated, even though it will be of great value to consider their interconnections
- the "factors" listed in the table below represent the "minimum set" needed in the framework.

Aspect	Factors	Required evidence
A **External requirements and learning outcomes**	Stakeholders with whom external requirements were identified Requirements identified: professional roles and the competencies needed to fill them Intended learning outcomes: knowledge, understanding and skills the student is expected to gain, and which are needed to develop professional competencies	**Table A1**: Interactions with external stakeholders **Table A2**: External requirements **Table A3**: Intended learning outcomes and associated course work
B **Teaching, learning and assessment**	Characteristics of students at enrolment Program structure and content Teaching materials and methods Student assessment methods	**Table B1a, B1b**: entry qualifications (selective admissions, orientation) **Table B2**: Curricular content **Table B3**: Contact hours Annex II: Modules' descriptions
C **Resources and services**	Faculty qualifications Technical and administrative support Infrastructures (lecture halls, classrooms, laboratories, libraries, facilities, equipment, etc.) Student guidance, counselling, academic support and welfare services	Faculty CVs: hypertext link in **Table B2** **Table C1**: Premises and equipment
D **Monitoring, analysis and review**	Student intake and progression (internal effectiveness) Student and graduate satisfaction Professional outlets for graduates (external effectiveness) Data analysis and commentary Periodic review activities	**Table D1**: Student enrolment and progression data **Table D2**: Further information, special initiatives Opinions of students participating in or about to complete the degree program Job placement data **Table D3**: Degree program analysis, monitoring and review

Table 2 – Structure of the MIRROR- Q.A. Framework

Table 3 in the next page underlines the logical structure of the **MIRROR- Q.A. FRAMEWORK.**

Table 3 – Q.A. Framework matrix

(Muzio M. Gola)

I level (design) evidence	**Main / reference Roles & target Competencies** List of Scholarly or Professional Roles or for which the Programme is specifically designed to prepare graduates; broad declaration of Competencies **Table A2 - External requirements** required to fill role - to exercise functions in role.		**Subject areas & Learning outcomes** Particular choice of Subject Areas in coherence with stated competencies; **Table A3: - Intended learning outcomes and associated course work** knowledge, understanding and skills the student is expected to gain, and which are needed to develop professional competencies.[1,2]			
II level (implementation) evidence	**Interactions with external stakeholders** 1 - Academic body or person representing the institution. 2 - External stakeholders. **Table A1 - Interactions with external stakeholders**	**External requirements** 1 - Expected characteristics of students at enrolment, **entry qualifications**: **Table B1a: selective admissions** **Table B1b:: for orientation** 2 - Perspectives and opportunities for graduates at local or national or international level(results and indications of sector studies).	**Teaching, learning and assessment** 1 - Overall structure of Programme, deployment of Subject Areas in Course modules. **Table A3: Intended learning outcomes and associated course work** **Table B2: Curricular content** 2 – Single Module descriptions: contents, teaching materials and methods, student assessment methods.	**Resources and services** 1 - Faculty qualifications. **Table B2: Curricular content** 2 – Technical and administrative support. 3 - Infrastructures (classrooms, labs, libraries, facilities, equipment, etc.). **Table C1: Premises and equipment** 4 - Student guidance and support.	**Monitoring, analysis** 1 - Student enrolment and progression data (internal effectiveness). **Table D1: Student enrolment and progression data** 2 - Student, graduate, (employer) satisfaction. (Student opinion surveys) 3 - Time to work. (Placement surveys) **Table D2: other data**	**Review Table D3: Degree program analysis, monitoring and review** **Periodic assessment of Programme adequacy and effectiveness**
III level (Quality assurance mechanisms)	**Organisation of interactions** Who, when, how, and documents on record.	**Determination of professional roles** Who, when, how and documents on record.	**Course implementation** Who, when, how, and documents on record.	**Resource and infrastructure control** Who, when, how, and documents on record.	**Data collection** Who, when, how for systematic collection of data on student progression, surveys of students' opinions	

The tables are divided in five sets. The following is a brief description of each one.

Table A0 - Front page. Historical Background. Presentation of the Program (this one in practice a commented index to facilitate the approach to the document).

Aspect A - External requirements and learning outcomes.

Tables A1: interaction with external shareholders: This table provides the bases for a systematic, open approach to determining the educational requirements of prospective employers. It identifies the party or parties who promote consultation, the external stakeholders involved, and the type and frequency of interactions. Hypertext links to documents on record are also provided.

Table A2: External requirements. Specifies the professional roles for which the degree program is designed to prepare graduates. These roles are described in terms of the functions exercised in them and the competencies required in order to fulfil them.

Table A3: Intended learning outcomes and associated course work. The knowledge, understanding and skills expected of the student are shown in relation to the course work and other educational activities whereby they are developed. The table thus details how teaching activities are organized in order to achieve the intended learning outcomes on several different level (knowing and understanding, knowing how to act, ability to make judgments, communication skills, self learning skills, knowing how to be).

Aspect B - Teaching, learning and assessment.

Table B1a: Entry qualifications (selective admissions) - Table B1b: Entry qualifications (for orientation): Attention to the overall quality of the educational process also centers on enter qualifications, distinguishing between the qualifications that students are requited to have in cases where admission to the degree program is restricted or selective, and those that are recommended for orientation purposes, i.e. will help students make informed decisions based on their own aptitudes.

Table B2: Curricular content- Table B3: Contact hours. These tables provide the information needed to organize resources and mange time. The first gives details of course titles and the number of teaching hours involved, while the second provides direct access to class schedules.

Aspect C.- Resources.

Table C1: Material resources and equipment: Provides details for the facilities and equipment used for teaching activities.

Aspect D - Monitoring, analysis and review.

Table D1: Student enrolment and progression data.

Table D2: Further information: Contains additional information introduced at the discretion of each degree program concerning student background and achievement, faculty stability, etc.

Table D3: Degree program analysis, monitoring and review: Summarizes the processes carried out as part of continual degree program improvement, detailing motivations, actions, and responsibilities for changes made to the program.

During the development of the project it was not possible to develop a scheme for the review checklist. Indeed, in the context it was considered premature, in view of the fact that a meaningful application would require official adoption of the **MIRROR- Q.A. FRAMEWORK** by the Faculty and an experimentation of at least two-to-three years on the field. It was agreed that this should be left to a possible continuation of the project in the years to come with further financing.

Part II of this Final report shows all the populated tables. (See Map in page 4)

Conclusions of the Orientation Committee [5]

At the closure of the last Orientation Committee meeting in Torino, June 15-16-17 2009, instructions for a further revision of the populated tables were issued, and the following concluding remarks were agreed.

The development of a "effectively working" internal Quality Assurance system requires the availability of a framework and documentation: such documents has been developed during the present ALFA-MIRROR project; it is the outcome of research activity consisting in a survey which has produced the **MIRROR- Q.A. FRAMEWORK** , i.e., a communication tool for QA of Engineering Education;

Three main needs were emphasized:

A - The institution and its degree Programmes must be able to choose the features of their quality management system independently, as this Q.A. Framework must be adapted to their size, academic aims, history and local context. The same is true of the information which will be needed to highlight quality factors and underpin control and improvement. The institution owns its quality management system, and it must be able to be evaluated/accredited on the basis of this Q.A. Framework.

B - Quality management must not consist only of inspections, audits and controls. Rather, it must inform the degree Programme's day-to-day operations, becoming an open window on the institution.

C - The degree Programme must provide the outside world with a basic set of uniformly organized information that enables stakeholders to make informed judgments, helps orient prospective students, and facilitates second-party and third-party evaluation/accreditation.

Meeting all three of these needs calls for an approach based on permanent monitoring: the Programme must be asked to produce and maintain a set of appropriate information, collected in an "information protocol" developed around a scheme here called Q.A. FRAMEWORK MATRIX (presented in Table 3).

The resulting information protocol has been titled the "MIRROR-Q.A. FRAMEWORK": it contains all the qualitative and quantitative parameters needed to arrive at an informed judgment about the degree Programme's aims, methods and the learning environment provided to the student.

The MIRROR-Q.A. FRAMEWORK is thus the foundation for all future evaluation/accreditation processes. It must satisfy minimum requirements for content and form so that degree Programmes of the same or similar type offered by different institutions can be readily compared.

[5] Paulino **Alonso,** Joao **S. Cordeiro,** Muzio M. **Gola**, Ismael **Mazón,** Robson **Pederiva,** Estela **Pereira,** Daniel **Samoilovich**

The proposed MIRROR-Q.A. FRAMEWORK, presented as a collection of tables, marshals the essential information that provides the basis for regarding a Programme as "assessable for accreditation purposes".

The FRAMEWORK has been tested against the needs of different institutions.

On completion of the Framework and of the associated Tables by each ALFA-MIRROR participant, we are in agreement that the implementation of MIRROR-Q.A. FRAMEWORK has the following advantages and features.

The populated tables of the MIRROR-Q.A. FRAMEWORK give a clear and concise picture of the educational Programme on offer.

Prior to the implementation of this Framework there is difficulty in comparing different Programmes as a result of different criteria to be followed. The concise standard format of information, concerning the common core of almost all criteria, can now be used in comparing different educational Programmes.

It is envisaged that current national procedures will not be superseded by the MIRROR-Q.A. FRAMEWORK , rather that this Framework will overcome the difficulty in comparing Programmes which are described using different formats.

The MIRROR-Q.A. FRAMEWORK captures the critical information which is required by stakeholders such as employers, the labour market, students, educational policy makers and educational establishments. It collects and collates all the details which are strictly necessary.

In the absence of any currently prescribed model, this Framework can be adopted as a Programme design tool as a checklist for its evaluation and as a guideline for the implementation of internal Quality Assurance.

The MIRROR-Q.A. FRAMEWORK is structured in a modular manner, making it possible to be effectively used in a web medium, therefore allowing access by the public at large, making it an instrument for transparency and control.

In the release of this Framework and associated Tables the SIG A4 anticipates that the format is flexible enough to be adapted to the individual institutional needs. However, it is recommended, to facilitate comparability, that the general format and the appearance of the tables should be maintained.

Moreover, the MIRROR-Q.A. FRAMEWORK should be flanked by periodic (presumably annual) reviews, where systematic observations and governing actions are given the appropriate evidence, thus proving that the Q.A. systems are effectively in operation. Support processes can be addressed in the tables purposely designed, and are essential in highlighting the quality of the organization in the planning and delivery of educational Programmes. The combination would describe quality factors and the actions involved in control, highlighting the degree Programme's strengths and weaknesses, corrective measures, review activities and follow-up, and their effects over time.