QUALITY POLICIES CONFORMED WITH ABET IN A SPANISH ENGINEERING SCHOOL

Edmundo Tovar
Language and Computer Science Systems and Software Engineering Department, Technical University of Madrid, Spain

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Abstract: The European Higher Education Area is an example of diversity of political systems, higher education systems, socio-cultural and educational traditions, languages, aspirations and expectations. In the light of this diversity and variety, technical universities set its face to develop their internal quality assurance systems according to the European standards and the guidelines, focusing more on what should be done than how they should be achieved, but also to different factors and sources. This presentation explains the definition of quality policies in a Spanish Engineering school, including engineering accreditation, programs, funding programs or improvement plans.

1 QUALITY IN THE EUROPEAN HIGHER EDUCATION

The issue of quality assurance has risen very high on the Bologna agenda and is seen now as one of the key instruments to promote the attractiveness of European higher education. It was made clear that when defining common criteria and methodologies in the European Higher Education is necessary to take into account the diversity of the various systems and traditions that will go into the construction of a comparable framework.

Harmonization should be the result of the conjunction of these traditions and should, under no circumstances, mean their reduction to a common pattern. For the implementation of an effective culture of quality, it is essential that governments, Higher Education Institutions (HEI), quality agencies, teachers and students all participate, in view of the expectation that this process will benefit not only all agents involved but also society at large. The Berlin Communiqué - while recognizing the role of HEIs in promoting quality invites the Quality Assurance (QA) and Higher Education communities to develop an agreed set of standards, procedures and guidelines on quality assurance (Roselló, 2004).

Institutions and agencies are achieved on a basis of greater transparency in accreditation processes.

To that end it is essential to promote a peer review process among agencies. But this proposal had a risk. The Institutional Evaluation Programme has given Europe a solid experience in transnational evaluation, evaluating close to 120 universities in 35 different countries. This ten-year experience, combined with the outcomes of the Quality Culture project, points to the fact that it is impossible to reach an agreement on quality standards when dealing with a diversity of institutions across a whole continent. On the other side, evaluation approaches -based on standards, quantitative methods, sets of criteria or checklists will not improve quality meaningfully and may not even control it significantly because they will not capture the complexity of the educational enterprise.

So, the Graz Declaration claims that "the universities are responsible for developing internal quality culture" and the Berlin Communiqué says that "the primary responsibility for quality assurance in higher education lies with the institution itself and this provides the basis for the real accountability of the academic system within the national quality network." As discussed at the Graz Convention (May 2003), among the policy goals for an appropriate European QA dimension are to achieve greater compatibility while managing diversity of QA procedures, to achieve trust and to preserve and extend institutional autonomy while meeting the demands for accountability. Autonomy is a precondition for a capacity to respond to change. Thus, university autonomy requires that each

Tovar E.
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institution decides on its standards in the context of its mission and goals (Wilson, 2004).

Increasing autonomy of HEI is the primary responsibility for quality. It is essential that the development of a European QA dimension accompanies and extends institutional autonomy in order to ensure that QA is not merely window-dressing and a compliance exercise. Quality assurance systems need to be flexible and embrace this diversity in order to ensure that higher education serves effectively society (Erichsen, 2004).

2 QUALITY POLICY IN A HIGHER EDUCATION INSTITUTION

The statement of Quality Policy in HEI documents the authority for the implementation of a quality management system in the form signed by the dean or director in charge of the institution implementing the quality management system. It must express the intentions of the institution concerning the quality of the academic offer and the rest of services and products it supplies. It is a way to guarantee the coherence of the processes, products and services covered by the quality management system.

According to ISO (ISO, 2005) with respect to the capabilities enclosed in the quality policy for which the organization is seeking certification, top management should ensure that:

- It is appropriate to the purpose of the organization
- It includes a commitment to comply with requirements and improvement the effectiveness of the quality management system
- It is understood and communicated a within the organization and
- It is reviewed for continuing suitability
- It provides a framework for establishing and reviewing quality objectives

Quality Management System, authorized and conformance by the existence of a Quality system, defines the policies, procedures, methods and standards for the management of the HEI. The policies for developing, implementing and maintaining the quality management system, first element of this Quality System, must be designed to ensure that stakeholders' requirements are met.

This paper proposes to identify these policies in European Engineering Higher Education, and its application in a Spanish Engineering School.

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Which are the stakeholders that provide sources for the desired quality deployment of the institution?

3 A PROCESS TO DEFINE EUROPEAN ENGINEERING HIGHER EDUCATION'S QUALITY POLICY

Herein it is proposed a three-phase process to identify the Quality Policy (Tovar, 2009). These are the following:

- Phase I. Which are the stakeholders that provide sources for the desired quality deployment of the institution? In the case of European Engineering HEI and according to our experience, we have selected the following stakeholders, as providers of policies: Strategic plans of the institution, Guidelines from National Quality Agencies, and funding programs for the institutions.
- Phase II. Elicitation of policies from the sources identified
- Phase III. Specification of a consistent Quality Policy. A Quality Policy is specified trying to gather all the policies extracted from the different sources or stakeholders. This is a sub process to be defined by each HEI that will require the prioritization of each set of policies and an effort of synthesis to express in an only statement maybe several redundant policies.

4 SOURCES FOR QUALITY POLICY

Strategic Plans. Leadership systems (Miller, 2007) are the systems within an organization that provide-

direction and support. The leadership system directs an institution trough mission, vision, guiding principles, strategic goals and organizational structure.

Many European universities combine these elements of leadership system and Strategic Planning from a perspective of continuous improvement. This process scarcely differs from those elaborated in the corporate setting in terms of who needs to be involved and in the relative emphasis on financial issues. The strategic planning process is usually generated from a self-assessment process or a more detailed evaluation using the corresponding national or European standards for quality in education. A tool that is widely used to stimulate the reflection in preparation for the strategic plan is SWOT (standing for strengths, weaknesses, threats and then on opportunities). It provides useful information building a common perspective about the current state of the institution to consider the future. Finally, once the politics and strategies goals have been defined, the organization moves in the desired direction thanks to the actions plans defined.

Guidelines of European Networks of Quality Agencies. HIE themselves have sought external benchmarks to sanction and justify their conclusions (Marcellán, 2005). Those responsible for higher education policy in Europe have pressed determinedly for the establishment of entities and organizations that will facilitate assessment initiatives for their improvement. In a further step forward, the establishment of networks of assessing entities was sponsored by the European Commission in exercise of its competences in respect of promoting the European dimension and incorporating added value to Member States' initiatives. The supreme such entity is the ENQA (ENQA's General Assembly confirmed on 4 November 2004 the change of the former European Network into the European Association) which was recognized by the conference of ministers at Berlin in September 2003 as the preferred interlocutor in matters of quality assurance in the European Convergence process. The Ministers of the Bologna Process signatory states invited ENQA through its members, to develop an agreed set of standards, procedures and guidelines on quality assurance and to explore ways of ensuring an adequate peer review system for quality assurance and/or accreditation agencies or bodies. The standards and guidelines were designed to be applicable to all HEI and quality assurance agencies in Europe, irrespective of their structure, function and size, and the national system in which they are located. It will be for the institutions and agencies themselves, cooperating within their individual contexts, to decide the procedural consequences of adopting the standards contained in this report (ENQA, 2004). (Table 1)

Table 1: European standards and guidelines for internal quality assurance within higher education institutions.

1.1	Policy and procedures for quality assurance: Institutions should have a policy and associated procedures for the assurance of the quality and standards of their programmes and awards
1.2	Approval, monitoring and periodic review of programmes and awards: Institutions should have formal mechanisms for the approval, periodic review and monitoring of their programmes and awards
1.3	Assessment of students: Students should be assessed using published criteria, regulations and procedures which are consistently applied
1.4	Quality assurance of teaching staff: Institutions should have ways of satisfying themselves that staff involved with the teaching of students are qualified and competent to do so
1.5	Learning resources and student support: Institutions should ensure that the resources available for the support of student learning are adequate and appropriate for each programme offered
1.6	Information systems: Institutions should ensure that they collect, analyse and use relevant information for the effective management of their programmes of study and other activities
1.7	Public information: Institutions should regularly publish up to date, impartial and objective information, both quantitative and qualitative, about the programmes and awards they are offering

Further, these guidelines reflect the statement of Ministers in the Berlin communiqué that 'consistent with the principle of institutional autonomy, the primary responsibility for quality assurance in higher education lies with each institution itself and this provides the basis for real accountability of the academic system within the national quality framework'. In these standards and guidelines, therefore, an appropriate balance has been sought between the creation and development of internal quality cultures, and the role which external quality assurance procedures may play (Puirséil, 2004). In this way, the purpose of these standards and

guidelines is to provide a source of assistance and guidance to HEIs in developing their own culture of quality assurance, and to contribute to a common frame of reference for the provision of higher education and the assurance of quality in the EHEA.

The Thematic Network in Engineering Education has worked developing a tool fully compatible with ENQA requirements and, in general the European trends toward internal Quality Assurance of Programmes (M. Gola, 2007). The tool developed is named: "Tool for Quality Assurance And Assessment of Engineering Education". The Q.A. FRAMEWORK is designed to be maintained on an ongoing basis rather than as a periodic reporting structure. For this reason it is recommended that the ongoing maintenance could be controlled and delivered by internal Faculty;

Taking into account basic Quality Assurance requirements and European guidelines, the Framework has been wrapped around Learning Outcomes and/or Academic Competences, which are now the most interesting development under way at the international level. During design of the Q.A. FRAMEWORK, this line of thought has been deployed into the following set of hierarchical core requisites.

- The Programme must be clearly designed around external Requisites and related 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 moment of the Stage or of the final project:
- The Programme must be clearly deployed 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 up-to-date equipment.
- The Programme appropriately certifies that Learning Outcomes have been reached, the exams have a certifying value

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

In the absence of any current 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.

Meeting all three of these needs calls for an approach based on permanent monitoring: the degree program must be asked to produce and maintain the Q.A. FRAMEWORK that contains all the qualitative and quantitative parameters needed to arrive at an informed judgment about the degree program's aims, methods and the learning environment provided to the student.

While this Q.A. FRAMEWORK is necessarily a public document, it can be flanked by a periodic "Selfevaluation Report" prepared exclusively for parties inside and outside the institution who are involved in any form of evaluation and accreditation. This "Report" would describe quality factors and the actions involved in control, highlighting the degree program's strengths and weaknesses, corrective measures, review activities and follow-up, and their effects over time.

The 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 programs of the same or similar type offered by different institutions can be readily compared. (figure 1)

Funds. Concerns about money and accountability in public services do exist in several European countries. These concerns have led to the rise of previous evaluative activities and a posteriori evaluation which seeks to discover how far goals have been met. The HEI in many countries in this context have moved towards expenditure-driven as opposed to demand-related budgeting. This shift has promoted performance related funding and encouraged Performance Indicators or Quality Indicators which permit finer targeting of resources (Cave 1994). Despite the existence of this fact, systems of HEI vary in many ways including the degree of autonomy in institutions and individual academics. Furthermore within any country different policies might be pursued for different sectors of Higher Education.

5 THE CASE OF A SPANISH ENGINEERING SCHOOL

We show the application of the previous process to obtain the Quality Policy of an Engineering School of the Universidad Politécnica de Madrid in the context of the development of its Quality Assurance

Figure 1: The Quality Assurance Framework Matrix (M. Gola, 2007).

System. In ahead, we comment the results each phase of the process.

The definition of the quality policy in the Computer Engineering School of the Universidad Politécnica de Madrid has required the selection of the following stakeholders of the general providers of policies: Strategic plans of the institution, Guidelines from National Quality Agencies, and funding programs for the institutions.

Figure 2 shows these results.

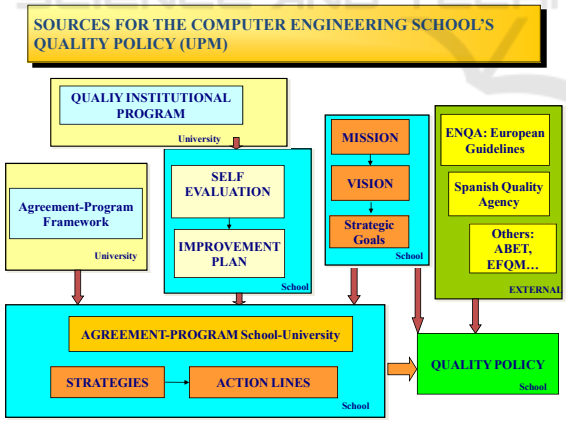

Figure 2: Quality Policy sources for a Spanish engineering school in a public university.

Strategic Plans. Strategic plans must distinguish those ones referred to the school and the university to which belongs. Although the Universidad Politécnica de Madrid (UPM) has currently an Institutional Quality Program (PIC), it has no strategic plan yet.

The UPM, (www.upm.es), approved in the year 2005 a quality program named "Programa Institucional de Calidad" (PIC, Institutional Quality Program) (UPM, 2005), with the following key objective: to measure the quality and to foster and to assist the initiatives of continuous improvement in the different Schools, departments and units of the institution.

The Mission and Vision Statements of the Computer Engineering School were approved last October (www.fi.upm.es). These are the basis too for the quality policy. As it says concerning to the accreditation: "… the academic offer shall be conformed to the European guidelines accreditation and others internationally recognized in the engineering sector…"

By this reason to establish a comprehensive quality policy and strategy, the criteria for quality certification and accreditation of different organizations in the USA and Europe have been taken into consideration, particularly ABET, Accreditation Board for Engineering and Technology (ABET, 2007), and Baldrige (Baldrige, 2007) in the USA, and EFQM (European Foundation for Quality Management, 2007) in Europe. Table 2 shows criteria for ABET Accreditation:

Table 2: ABET accreditation criteria.

1	Students: Admissions & Graduation Requirements, Evaluating Student Performance, Transfer Credit, Advising & Career Guidance
2	Program Educational Objectives: Consistency with Mission, Constituency Involvement, Achievement of Objectives

Table 2: ABET accreditation criteria (cont.).

3	Program Outcomes: List the outcomes that have been established for the program, Describe how the program outcomes encompass and relate to the outcome requirements of Criterion 3. State how each of the outcomes lead to the achievement of the Criterion 2 objectives. Describe the process used to achieve each of the program outcomes.
4	Continuous improvement
5	Curriculum: Evidence that the minimum credit hours and distribution are met. Information on capstone or other integrated Experiences
6	Faculty competencies and size
7	Facilities: Describe program classrooms, laboratory, facilities & equipment, computing equipment, and information infrastructure. Budget and Financial Resources.
8	Support: Program Industrial Advisory Committee
9	Program Criteria: Describe how the program satisfies any applicable

The preliminary conclusion is that, in general terms, the policy and strategy elements defined in the above mentioned criteria are quite similar to those covered by other sources: ENQA and ANECA guidelines, and the Institutional Quality Program, PIC, of the UPM. On the other hand, the certification criteria usually provide with more detailed quality requirements, since they focus on "how the organization does" kind of questions to evaluate the performance of the organizations. For this reason, the certification or award criteria are very useful as a guidance to identify the key processes in the organizations.

Guidelines of Quality Agencies. In Spain, the Agency ANECA (Agencia Nacional de Evaluación de Calidad y Acreditación: Nacional Agency for Quality Evaluation and Accreditation), member of ENQA, has adapted the ENQA guidelines to the Spanish context and has published a document (ANECA, 2007) with a set of guidelines for the systems of internal quality guarantee within HEI.

These ones should become in part of the quality policy of any institution conformed to these guidelines.

Funds. The PIC protocol establishes the need of a Program Agreement to be subscribed by the Chancellor and the directors of every HE institution. The aim of this program is to align the objectives of the Schools that form the University to a unique UPM policy and strategy, and to provide - the stakeholders with reliable information on the fulfilment of the agreed objectives.

With the above scope, the University has defined a "Framework of Program Agreement" (UPM, 2005) that will assure a common focus of improvement objectives, goals and indicators, with the flexibility required to adapt every Program Agreement to the particular improvement needs of the different Schools. The results of the Program Agreements will allow - the Schools to get an additional funding over the fix budget.

The structure of the Framework of Program Agreement is based on these three action lines:

- Line 1: Budgetary distribution of the operating and overhead expenses
- Line 2: Assistance to the implementation of improvements plans
- Line 3: Continuous improvement processes at the Schools

In table 3 are represented some of the most significant objectives of - line 2, assistance to the implementation of improvements plans, since they will be used, along with the line 3 objectives, in order to compare the strategic objectives of the different sources taken into consideration in this paper.

Table 3: Line 2 Program Agreement Framework objectives by areas.

Area	Objectives
Educational programs Planning	• Increment the number of new students • Educational profile taken into account the social and stakeholders needs • Curriculum and educational programs review • Implementation of mechanisms to track and – steer the development of the plan
Teaching, learning and Evaluation processes	• Improve and update the contents of the courses • Update and improve of the teaching-learning methods
Support to and communication with the students	• Facilitate the integration of new students • Design and implement tutorial plans • Funding assistance • Students placement and scholarships

Table 3: Line 2 Program Agreement Framework objectives by areas (cont.).

Resources and infrastructure	• Planning, evaluation and review of the library resources • Update the classrooms and labs to the current and future needs • Update and improve the ICT resources to the current and future needs
External relations	• Foster the external presence • Strength the relationships with alumni • Post graduate courses • Programs for knowledge and technology transfer
School Structure and Organization	• Faculty and Staff needs focus • Improve the Human Resources policies and management
Faculty and Staff training and support	• Promote and support the professional development • Encourage the participation in educational, research and innovation activities • Acknowledgement of the excellence in educational and research activities
Information management	• Put in place systems to capture, analyze and disseminate the information

Finally, we broach the specification of well-written policies, conformed to properties as precision, non ambiguity, relevance or non redundant. Because we start from statements elicited from several sources we had to make several actions to assure not only the previous properties mentioned but also other ones as consequence of the gathering process: coherence, integrity and coverage of the policies selected

These were the actions taken:

- Matching of the terminology used in each source, in order to assure.
- Distinguishing the priority of the different sources. In Spanish context Audit's policies are mandatory and they must be embedded in the final policy declaration. ANECA will verify the Internal Quality Assurance System of the School according to their guidelines.
- Defining quality policies with partial contributions of policies from all the sources matched by common areas. An example of how a policy is defined through the contribution of several policies from different sources can be seen in table 4.
- Validating the coverage of the quality policies defined with respect to all the strategic goals expressed in the sources considered.

Table 4: Example of elaboration of a Policy from multiple sources.

Example of final policy	Source's Policy	Source
The school shall control the existence, efficiency and effectiveness of mechanisms to assure the access, management, and training of its academic staff according to the functions assigned as well as the acknowledgement of its merits.	1.3 The University must implement mechanisms that assure the access, management and training of Faculty and Staff should be done with the necessary guarantees to fulfill their duties.	AUDIT
	3.10 Improvement of the scientifist acknowledge of academic staff in its knowledge area incrementing the number of publications	UPM Program Agreement
	L4. Promotion of the academic staff in teaching quality projects in the UPM	PIC
	L3. Linking training plans to the needs of services delivering	PIC
…	…	…

6 CONCLUSIONS

The issue of QA has risen as one of the key instruments to promote the attractiveness of European higher education Area. The Berlin Communiqué recognized the role of HEIs in promoting quality to develop an agreed set of standards, procedures and guidelines on quality assurance. HEI's autonomy is, by this reason, a precondition for a capacity to respond to the change. Thus, university autonomy requires that each institution decides on its standards and in the definition of the quality policies in the context of several sources. This paper has presented the process followed by the Computer Engineering School of the Universidad Politécnica de Madrid to elaborate the Quality Policy of the School, according to the

different elements, strategic elements, national quality agency and funds program of the HEI, concerned to this school This practical case is an example of how an European Engineering school develops its autonomy.

REFERENCES

G. Rosselló, General conclusions. New trends and proposals, Seminar on Methodological common instruments for assessment and accreditation in the European framework, Santander, July 28th - 30th 2004.

L. Wilson, Common instruments for assessment and accreditation in Europe, Seminar on Methodological common instruments for assessment and accreditation in the European framework, Santander, July 28th - 30th 2004.

H. Erichsen, Common instruments and criteria for accreditation, Seminar on Methodological common instruments for assessment and accreditation in the European framework, Santander, July 28th - 30th 2004.

ISO, "ISO 9000: 2005 Quality Management Systems", 2005.

E. Tovar, J. Carrillo, Creating transparency for mutual recognition in technical teachings through Internal Quality Assurance Systems, 38th ASEE/IEEE Frontiers in Education Conference, ISBN 978-1-4244-1970-8/08, October 22 – 25, 2008, Saratoga Springs, NY.

B. Miller, Assessing organizational performance in Higher Education, J. Wiley and Sons Inc, 2007.

F. Marcellán, "The role of networks in the promotion of mutual recognition of decisions on accreditation" ANECA, Seminar on Methodological common instruments for assessment and accreditation in the European framework, Santander, July 28th - 30th 2004.

ENQA, "Report on Standards and Guidelines for Quality Assurance in the European Higher Education Area", http://www.enqa.net/bologna.lasso Helsinki, 2005.

S. Puirséil, "Methodological common instruments for assessment and accreditation in the European framework. Compatible instruments for quality assessment", Seminar on Methodological common instruments for assessment and accreditation in the European framework, Santander, July 28th - 30th 2004.

M. Cave, S. Hanney, M. Henkel and M. Kogan, The use of performance indicators in Higher Education, Kingsley Publishers, 1997

M. Gola, TREE – Teaching and Research in Engineering in Europe Special Interest Group A4 "Tools for Quality Assurance and Assessment of EE" *Q.A. Framework* - Final Report, Latest Version, 07.08.07

UPM, *PIC: Programa Institucional de Calidad*. UPM. www.upm.es/innovación. 2005.

ABET, Board of Directors, "Criteria for Accrediting Engineering Programs during the 2008-2009 evaluation cycle", www.abet.org., 2007.

Baldrige National Quality Program., "Education Criteria for Performance Excellence". www.baldrige.com/baldrigecriteria.htm, 2007.

EFQM. "EFQM Excellence Model". www.efqm.org. 2007.

UPM, "Marco de Acuerdo Programa de la Universidad Politécnica de Madrid para la mejora de la calidad de los centros universitarios 2006-2009". UPM. www.upm.es/innovacion, 2005.

ANECA. "Directrices, definición y documentación de Sistemas de Garantía Interna de Calidad de la formación universitaria". Documento 02. PROGRAMA AUDIT. www.aneca.es. 2007.

BRIEF BIOGRAPHY

Edmundo Tovar, Computer Engineering educator, has a Ph. D. (1994) and a Bachelor's degree (1986) in Computer Engineering from the Universidad Politécnica de Madrid (UPM). He is Certified Software Development Professional (CSDP) from the IEEE Computer Society and he has worked for five years in private companies as a knowledge engineer and in Public Administration as a Software Engineer. Expert evaluator in Accreditation processes with the Spanish Agency for Quality Assessment and Accreditation, ANECA, he has been involved as a researcher in software quality management tasks in international projects since 1988, managing several innovative projects in education in the context of the European Higher Education Area. He is Associate Dean for Quality and Strategic Planning in the Computing School of the Universidad Politécnica de Madrid. Leader of a Innovation Group in Education in the Universidad Politécnica de Madrid is author of more 40 papers in Engineering Education, and member of several Program Committees in Congresses of this area, he is cochair for Europe of Frontiers Education Conference (FIE) and member of IEEE RITA Editorial Committee. He is IEEE Senior Member, and, as at-large member of the Administrative Committee of the IEEE Education Society.