

# CHALLENGES OF EDUCATION IN NATIONAL QUALITY INFRASTRUCTURE IN THE EU

VASILEIOS MAVROEIDIS

**Abstract:** *Quality has always been an important issue which especially relevant for trade-related activities. Aspects of quality must be transformed in measurable criteria, therefore industrial countries rely on many standards and technical regulations. Standards implementation is supported by National Quality Infrastructure (NQI) composed of standardization, metrology, testing, certification and accreditation bodies. The European Union – despite its comprehensive standards policy – lacks a corresponding European strategy in standardization and NQI education. There are only very few higher education establishments in Europe that teach NQI as an independent subject. Academic teaching in the field of standardization – NQIs in Europe does therefore not correspond to the status that it should have in safeguarding the worldwide competitiveness of Europe. The aim of this analysis is to identify and discuss challenges related to future NQI education framework in Europe at the higher education level that is needed to strengthen Europe’s position in the international arena. These challenges include: a proper identification of needs, selection of best practices related to NQI education, development of academic content and elaboration of formula for the Forum of Educational Bodies and other Stakeholders. The paper covers as well a comprehensive description of current situation regarding NQI education in the EU in perspective of Asian countries that have already developed their NQI education frameworks.*

**Keywords:** *National Quality Infrastructure, standardisation, education, European Union*

**JEL Classification:** *M110, M190, A230*

## 1. INTRODUCTION

Quality has always been an important issue, and numerous publications have appeared on this subject in the past in all parts of the world. Since, however, the spirit of globalization has been blowing throughout the world and has triggered an immense exchange of products and services, a new perspective has emerged. Aspects of quality must now be transformed from subjective perceptions into worldwide marketable and negotiable objective criteria which are then, in international and regional standardization, metrology or accreditation organizations, converted into consensus-capable standards. In these organizations, the corresponding structures for a harmonization and mutual recognition are established. [13].

Industrial countries rely on many standards and technical regulations for their trade-related activities. Standards implementation is supported by National Quality Infrastructure (NQI) composed of standardization, metrology, testing, certification and accreditation bodies. NQI is related to competitiveness and innovation management, sustainable development and business excellence which are elements of dynamic system of NQI, called as NQI – extended. [12]. At the macroeconomic level subsequent elements of NQI have impact on macroeconomic performance through reduction of transaction costs. Reduction of transaction costs is claimed to be the main channel transforming functions of NQI into positive outcomes like: increase in productivity, volume of international trade, competition and innovation activity. The ultimate target group of an NQI is in fact, the entire population, because more competitive companies, greater integration into the world trading system, and improved consumer and environmental protection, have a positive impact on the labor market, income levels and quality of life. [13].

## 2. SCIENTIFIC AIM

Although the need for NQI professionals in Europe is still more latent than manifest in order to boost Europe’s competitiveness stemming from standards’ implementation a comprehensive NQI educational kit is necessary. The aim of this analysis is to present challenges related to development of NQI education in Europe at the higher education level. This should be done by moving toward a modern, standardized NQI education in Europe including mutual recognition of educational qualifications, study achievements and the contents of curricula. In this way a new profession will be developed enriching the European labor market and preparing NQI experts to meet challenges related to contemporary globalized economy.

The study has a conceptual character. It provides the analysis of a current situation of NQI education both in Europe and in the countries that have already designed and implemented educational programmes in this field. Then the challenges related to European future model of NQI education are identified and discussed.

## 3. CURRENT SITUATION OF NQI EDUCATION IN ASIAN COUNTRIES AND EUROPE

Standards are a vehicle for sharing knowledge, technology and good practices. The nature, role and importance of standards (and in particular of international standards) in technology, business operations, trade, societal issues and legal matters, is in itself a subject which may be incorporated into curricula of universities and of other schools – and it is indeed increasingly recognized in education programs around the world, covering a variety of fields. ISO and National Standards Bodies (NSB) recognize the fundamental contribution that universities and, more in general, education institutes, can give to standardization in terms of:

- Teaching what is and what can be achieved through standardization: in specific technical fields, or from a more general perspective (contribution of standards to economic efficiency, public welfare, economic development and trade, sustainability),
- Developing academic studies and research work aiming at investigating the multi-faced relation between standards and innovation, international trade, business strategy, public welfare, sustainable development and other matters,
- Participating in the development of standards, providing the valuable contribution of academia's work on the cutting edge of research and technology.

The picture of education in standardization and NQI is differentiated. There are huge variations between Asian and European countries. Several Asian countries, implement standardization to their education programs. The governments of the member countries of the Asia Pacific Economic Cooperation (APEC) have decided to implement standardization education in their countries 2006 – 2010. Information on teaching activities on standardization in Asian countries is included in table 1.

**Table 1** Education in standardization in Asian countries

	KOREA	JAPAN	INDONESIA
Number of courses in standardization	81 (2011)	51 (2012)	18 (2012)
Number of Higher Education Institutions involved standardization education	41 (2011)	32 (2012)	10 (2012)
Number of students	3883 (2011)	2100 (2012)	1036 (2007-2012)

Source: [7]

Korea's efforts in standards education are in alignment with top-down approach and can be characterized as an outcome of public sector leadership. Two organizations, KATS (Korean Agency for Technology and Standards) and KSA (Korean Standards Association), have played key roles in planning and implementing standards education activities in Korea. In Indonesia, the importance of the relation between standards and education has been clearly recognized several years ago and the efforts to establish and promote cooperation with universities (and schools of other levels) have been driven by the national standards body, BSN (BSN is a non-departmental government institution whose main responsibility is to develop and conduct standardization activities in Indonesia). [9].

The European Union – despite its comprehensive standards policy – lacks a corresponding European strategy in standardization education. In Europe there is a great discrepancy between policy and practice. It is the official policy of the European Commission and the European Parliament to promote the European standardization system, of which it has high expectations. However, current practice shows no more than fragmented standardization education activities in the EU and hardly any programs at the academic level [8].

European standardization education activities are fragmented without a coherent approach. It can be stated that there are only very few higher education establishments in Europe that teach NQIs as an independent subject (optional subject). Essentially, a limited knowledge of standardization is included in individual lectures as part

of the subjects studied in courses such as mechanical engineering, electrical engineering, information technology, business administration and law. Academic teaching in the field of standardization – NQIs in Europe does therefore not correspond to the status that it should have in safeguarding the worldwide competitiveness of Europe. The essential point is the lack of investment in an academic infrastructure for NQIs in Europe. This is the reason why it is falling behind countries such as Korea, Japan and China.

Various sources assess the current state of Education in Standardization (SE) activities in Europe (see: [1], [2], [3], [4], [5], [10], [11]). More than 80 European academic entities are identified, although this number should instead be regarded as a "lower boundary", because presumably not each and every European SE activity was disclosed. Most European SE activities are taking place in higher education establishments. Approximately 70% of the above-mentioned entities represent universities, business schools, technological educational institutes and the like. Often standardization issues are addressed in passing in a broader context and/or for rather practical reasons and courses entirely devoted to standardization are still exceptions. Some standards bodies are commercial players on the education market. They offer courses for which companies and other stakeholders are willing to pay but this insufficiently solves the problem related to the first barrier for SMEs to profit from standards and standardization: their lack of awareness. Standards bodies' further educational activities can be seen as complementary to those of universities and other public educational organisations. It is therefore important to distinguish between professional training in the field of standardization and academic education in the field of standardization.

In the professional training sector, the national standards bodies provide good measures for company employees to achieve professional qualifications. Academic education in the field of standardization is not an activity of standardization bodies; it should be integrated into the state education system at universities, in line with the European tradition.

There is only a very limited academic infrastructure in the field of standardization at higher education establishments; there is no curriculum with defined core contents, no recognized textbook on standardization. [7]. The emphasis of the courses varies considerably from university to university. It ranges from standardization governance, strategic aspects of standardization to development of IT standards and e-business applications.

According to a survey by Egyedi [6] the following tendencies related to education on standardization have been identified:

- 84 European entities are active in Education in Standardization but there is a difficulty to consolidate data.
- Primary education level: there is no Education in Standardization activities.
- Secondary education level: there is no coordinated, systematic Education in Standardization activities. Standardization issues may occasionally become a subject-matter in secondary education, e.g. in homework essays.

- BSI Education, as an exception, actively approaches all ages and all educational levels.
- Austrian Standards Institute (ÖN) has developed a set of tools for secondary level teachers (CD-ROM).
- Most European Education in Standardization activities are taking place in Higher Education Institutions.
- Courses entirely devoted to standardization are still an exception.
- Often standardization issues are addressed in passing in a broader context and/or for rather practical reasons.
- Large European countries like United Kingdom, France and Germany explicitly address Education in Standardization in strategy papers.
- Many smaller European countries do not have an Education in Standardization strategy. Education in Standardization activities hardly go beyond Professional Education provided by National Standardization bodies.

Thus summarizing, there is no uniform concept of the EU standardization education system.

The need for standardization education in industry is latent rather than manifest. There is some demand for “standards engineers” (experts) but there are neither official descriptions nor formal training for such positions. Due to the lack of a formal curriculum, the selection of such professionals is mostly based on their previous practical experience in standards and related standardization activities, and on their proficiency in specific soft skills. In addition to the technical standardization experts (standards engineers), who are usually appointed as technical experts for the development of standards in standardization committees, there are two other demand groups in companies. Firstly, the employees in the standardization departments – if any – are main contacts and coordinators for all standardization activities within the company; secondly, the management as a decision/maker for strategic standardization activities in the company has to be granted a principal role. Here, especially, the strategic aspects of standardization are important.

To strengthen Europe’s position in the international arena, a comprehensive European approach to standardization education is needed. [8]. This should be done by moving in the direction of a system of standardization education in Europe including mutual recognition of educational qualifications, study achievements and the contents of curricula. This would create an EU market for standardization experts according to a predefined qualifications framework.

#### 4. CHALLENGES OF FUTURE NQI EDUCATION FRAMEWORK IN THE EU

Several challenges related to future NQI framework in Europe can be identified. They depict both educational market (demand and supply side) and practical aspects of educational curricula elaboration and include the following aspects:

- Identification of needs regarding NQI education

It is crucial to understand what the industry and other stakeholders expect from NQI professionals and what are their real needs related to standardization processes. As it was already stated the need for standardization education in industry is latent rather than manifest. Therefore

identification of such needs and creation of their catalogue is a prerequisite for further activities.

- Selection of best practices related to NQI education

According to research cited in previous points NQI education is already well developed in several countries. It is therefore justified to look carefully at experiences of these countries, compare them critically, review and derive best practices that could be also be used in the EU.

- Development of the European qualifications framework of NQI education

A qualifications framework shows what a learner knows, understands and is able to do on the basis of a given qualification – that is; it shows the expected learning outcomes for a given qualification. It also shows how the various qualifications in the education or higher education system interact, that is how learners can move between qualifications. The European qualifications framework of NQI education should combine knowledge (theoretical and factual knowledge), skills (cognitive and practical skills) and competencies (responsibility and independence) as stipulated in the qualifications frameworks in the European Higher Education Area. The qualifications framework has to be linked with a national qualifications framework for education in the same field in the EU member states.

- Elaboration of Academic Content for NQI education

All aspects related to a practical implementation of the European qualifications framework of NQI education should be considered like:

- development of curricula for Bachelors and Masters level based on European culture as well as market needs (for e.g. technical, business, economics and law studies),
- developing teaching materials, in particular materials that are attractive for both students and teachers such as teaching cases,
- creation of a repository of teaching materials and approaches,
- investigation of the need for European diplomas for standardization with education programs to prepare for these diplomas.
- Development of formula for the Forum of Educational Bodies and other Stakeholders

This forum should coordinate all actions related to education on NQIs and all levels of its implementation. It should gather all the stakeholders active in the field of NQIs education representing public and private sectors from all the EU member states and also big multinational companies, the European bodies, etc. The forum should play advisory and monitoring roles.

In order to build a future NQI education framework a close cooperation between stakeholders is essential. It is especially valid for national standardisation bodies and universities which are the key enablers of education in the field. They should cooperate at different levels: international, national and regional. Such cooperation demands mutual understanding of relations between standards’ implementation and a proper professional preparation of practitioners active in the field of NQIs. At the same time several obstacles hindering efficient cooperation between stakeholders should be overcome.

These obstacles comprise lack of a broadly understood infrastructure (e.g. teaching materials, experts, university professors, financial resources) as well as a low level of awareness about importance of education in NQIs (for details see: [9]).

## 5. CONCLUSION

Standards and standardisation have become the main vehicles of quality. Quality, in turn, boosts trade through increase in innovativeness and competitiveness. Development and implementation of standards require a special infrastructure which is embodied in the form of NQI. Although the EU standardisation policy is advanced, surprisingly, education in this field is fragmented and underdeveloped in comparison to its main Asian competitors. As the EU has developed its own standardization practices and NQI that has similar functions and collaborate at the European level, European education in this field is equally needed as it should be unified and standardised.

Till now a common NQI education framework does not exist. Therefore to strengthen Europe's position in the international arena regarding its competitiveness, volume of international trade and innovativeness, a truly European approach to NQI education is needed. In order to elaborate such a framework possible challenges should be identified and practically addressed. The challenges are related to demand and supply at the NQI educational market and practical aspects of academic curricula development. Involvement of stakeholders is very important as they provide necessary information needed to build a highly efficient educational framework.

Through implementation of a future NQI education framework a new profession will be developed enriching the European labor market and preparing NQI experts to meet challenges related to contemporary globalized economy and increasing the EU competitiveness. This will profit European business, higher education institutions, individual NQI professionals and other NQI stakeholders like NQI bodies.

## REFERENCES

- [1] ACYL, A., BORDE, J. M. 2003. *Training and education for standardization in Europe – Volume 1– Survey report*. 2003. Akela Business Engineering. A Study commissioned by Sun Microsystems.
- [2] CHOI, D. G., DE VRIES, H. J., KIM, D. 2009. *Standards Education Policy Development: Observations based on APEC Research*. International Journal of IT Standards and Standardization Research, 2009, 7(2), p. 43-63. ISSN 1539-3062.
- [3] CZAYA, A., HESSER, W. 1999. *Standardization as a subject of study in higher education*. ISO Bulletin, 1999, 30(6), p. 6-12, Retrieved from [http://www.iso.org/iso/article\\_bull\\_june\\_99\\_-\\_stdzation\\_study\\_higher\\_education.pdf](http://www.iso.org/iso/article_bull_june_99_-_stdzation_study_higher_education.pdf).
- [4] DE VRIES, H. J., EGYEDI, T. M. 2007. *Education about Standardization –Recent Findings*. International Journal for IT Standards and Standardization Research, 2007, 5(2), p. 1-16. ISSN 1539-3062.
- [5] DE VRIES, M. J. 2005. *The Nature of Technological Knowledge: Philosophical Reflections and Educational Consequences*. International Journal of Technology and Design Education 2005, 15(2), p. 149–154. Online ISSN 1573-1804.
- [6] EGYEDI, T. M. 2009. *The State of Standards Education in Europe*. ICES Workshop, Tokyo, 23-24 March 2009. Retrieved from [http://www.standards-education.org/uploads/ices2009/European\\_Standards\\_Educ\\_ICES2009\\_EgyediFinal.pdf](http://www.standards-education.org/uploads/ices2009/European_Standards_Educ_ICES2009_EgyediFinal.pdf).
- [7] HESSER, W. 2014. *Memorandum on Standardization in Higher Education in Europe*. 2014. 1 p.; 3 p. Retrieved from <http://www.iso.org/sites/edumaterials/hesser-memorandum.pdf>.
- [8] HESSER, W., VRIES, H. 2011. *White Paper: Academic Standardization Education in Europe*. EURAS, 2011. 15-18 p.; 5 p. Retrieved from <http://www.euras.org/uploads/files/EURAS%20White%20paper%202011-08-13.pdf>.
- [9] ISO 2012. *Cooperation between National Standards Bodies and Universities*. ISO/KATS regional workshop, 7 – 9 May 2012, Proceedings. 6-8 p. Retrieved from [http://www.iso.org/iso/iso\\_kats\\_workshop\\_proceedings.pdf](http://www.iso.org/iso/iso_kats_workshop_proceedings.pdf).
- [10] KOREAN STANDARDS ASSOCIATION 2008. *APEC SCSC Education Guideline 1- Case studies of how to plan and implement standards education programs and strategic curriculum model*. Singapore: APEC Secretariat, Publication number APEC#208-CT-03.2, Retrieved from [http://publications.apec.org/publication-detail.php?pub\\_id=69](http://publications.apec.org/publication-detail.php?pub_id=69).
- [11] KUROKAWA, T. 2005. *Developing Human Resources for International Standards*. Science & Technology Trends - Quarterly Review, No. 17, October 2005, p. 34-47. ISSN 1349-3671.
- [12] MAVROEIDIS, E., VARDAKAS, E., 2013. *Quality Infrastructures improve the economies of Eastern European and Balkan countries*. Journal of Applied Economics and Business (JAEB), Vol.1 No.2, 2013, p 35-45. ISSN 1857-8721.
- [13] SANETRA, C., MARBÁN, R. 2007. *The answer to a Global Quality Challenge: A National Quality Infrastructure*. Physikalisch-Technische Bundesanstalt, Germany, June 2007. 51; 16. p. Retrieved from [http://www.ptb.de/cms/fileadmin/internet/facha\\_bteilungen/abteilung\\_q/q.5\\_technische\\_zusammenarbeit/q5\\_publicationen/102\\_National\\_QI/PTB\\_Q5\\_National\\_QI\\_EN.pdf](http://www.ptb.de/cms/fileadmin/internet/facha_bteilungen/abteilung_q/q.5_technische_zusammenarbeit/q5_publicationen/102_National_QI/PTB_Q5_National_QI_EN.pdf).

**Vasileios MAVROEIDIS, Dr Eng., M.Sc.**

Hellenic Open University, School of Science and Technology, Quality Assurance M.Sc. Program

Parodos Aristotelous 18, 263 35 Patras, Greece

e-mail: vasilis.mavroidis@ac.eap.gr