



**EKONOMICKÁ
FAKULTA**

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NEEDS OF MULTIDISCIPLINARY EDUCATION IN THE FIELD OF INFRASTRUCTURE QUALITY

The Start of a Discussion

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Context

Given the nature of this group it would be tempting to focus on the education infrastructure needs relating specifically to *market surveillance*.

We choose to deal with the whole of standards as it is like a chair.

The standards infrastructure is only as strong as its weakest component.

It may be relevant to focus on one aspect

Outline

In this I will focus on university education and courses and long term solutions to current problems, rather than, e.g., one-off two week courses – although they too have a role.

By infrastructure I am referring to the infrastructure of standards and standardization.

This covers the institutions of standardization, accreditation, conformity assessment, metrology and market surveillance

But we will also be concerned with the users of that infrastructure

Now some definitions

Multidisciplinary Education

An approach to curriculum integration which focuses primarily on the different disciplines and the diverse perspectives they bring to illustrate a topic, theme or issue.

A multidisciplinary curriculum is one in which the same topic is studied from the viewpoint of more than one discipline.

<http://www.ibe.unesco.org/en/glossary-curriculum-terminology/m/multidisciplinary-approach>

Multidisciplinary Education

It is a process for providing a summary of disciplines that is additive, not integrative; the disciplinary perspectives are not changed, only contrasted.

For example IT standards can be studied not only within IT technology but also within economics, the law, and business.

Each part of the course would be taught from a specialist from that area.

Compare this to: An Interdisciplinary Approach

is a synthesis of two or more disciplines.

For example, when methods from mathematics were transferred to physics, mathematical physics was born, a new discipline

<http://www.ibe.unesco.org/en/glossary-curriculum-terminology/i/interdisciplinary-approach>

Why?

It is important that people involved in standards, not so much engineers in firms, but in standards bodies such as the national, EU and international ones, have an understanding of the economics of standards.

How standards can impact on competition and innovation in both a positive and a negative way. This requires a knowledge of economics.

A knowledge of business studies, the law and politics is also desirable.

Also specialist standards activities such as Market Surveillance is really multidisciplinary, which needs technical but also other expertise.

But a typical university economics course is not always totally relevant for standards and those in standards. Economics courses specifically designed for users of standards would be better, but more difficult to put on than 'off the shelf' economics ones.

An alternative view of 'narrow' multidisciplinary

sees people coming in from a narrow band of subjects, e.g. different aspects of engineering, such as standardization, conformity assessment, metrology.

Even though the engineer designing a new product involving a new standard, or using an existing standard will not themselves be engaged in conformity assessment and metrology, they need to be aware of these areas as the product they are developing will have to pass through conformity assessment to be certified.

Not so much multidisciplinary as multi-background

Standards education is also different to many other university courses in the extent to which it can profitably draw on the knowledge and the experience of the practitioner outside of academia.

There is the potential, frequently realised, for integrating practitioners into the education process of the student and integrating the student into the practice via a placement, internship or visit.

An example of a multidisciplinary degree

- The College of Standardization in China's Jiliang University offers a Bachelor's degree in Management, with a major in Standardization Engineering. The courses available in the major are chosen from:

Basic Courses College English

Advanced Mathematics

Probability and Statistics

Linear Algebra

Basic Courses

Engineering and Technology

Physics Chemistry Electrotechnics and Electronics

Mechanical Design

Measurement Technology

Engineering Cartography

Engineering

Courses

Microeconomics

Macroeconomics

Theory of International Trade

Management Theory

Marketing

Financial Management

E-Commerce

Economics and

Management

Courses

Metrology

Evaluation of Measurement Uncertainty

Reliability Engineering

Statistical Processing Control

Design of Experiment

Quality Management

Theory and Methods of Standardization

Standardization Principles

International Standardization

WTO/TBT-SPS and Technical Barriers to Trade

ISO 9000 Family of Standards and Quality certification

Environmental Management System Certification and ISO 14000 Standards

ILIAS E-Learning Platform

Electrotechnics & Electronics Practice

2 weeks Metalwork Practice

Standardization Internship

Pre-graduation Project about Standardization

*Standardization
Courses*

*Field
Practice*

Another example

In general some Asian countries are much more advanced in providing a standards education than we in Europe.

Another Example is from Korea

The University Education Promotion on Standardization (UEPS) stimulated and influenced the teaching of standards in Korea.

This is slightly less multidisciplinary, very standards focused including metrology and conformity assessment

Choi, D. G., & de Vries, H. J. (2013)

Integrating standardization into engineering education: the case of forerunner Korea.

International Journal of Technology and Design Education, 23(4), 1111-1126.

The syllabus for the general UEPS (The University Education Promotion on Standardization) courses was.

I. Introduction of standardization

- **1. Standardization overview: Definitions, classifications, objectives, impacts and importance**

II. Standardization activities

- **2. International standardization**

International standards, standardization, organizations

- **3. National standardization**

Development, structure, implementation and future

- **4. Company standardization**

Business strategy, management, and standardization

III. Contents of standards

- **5. Metrology and reference materials**

Scientific/industrial and legal metrology, reference materials, SI, international cooperation

- **6. Conformity assessment**

Conformity assessment overview, conformity assessment in Korea, major countries, mutual recognition agreement

IV. Use of standards

- **7. Standards and IPR**

IPR and economic activities, standards and IPR, standardization and anticompetition

- **8. Future of standards**

Current and future trends and issues of standards

More for the engineers involved in standards

Not all roles in standardisation require a wide multidisciplinary education. Metrology e.g.. Thus the University of Coventry in the UK offer the following modules:

- **Introduction to Metrology**
- **Mathematics for Metrology**
- **Engineering Science for Metrology**
- **Standards and Traceability in Metrology**
- **Measurement Methods**
- **Uncertainty in measurement**
- **Measurement Systems Analysis**
- **Coordinate metrology practices**
- **Production measurement practices**

This is in the context of a foundation degree in metrology. A **foundation degree** is a combined academic and vocational equivalent to two thirds of an undergraduate degree. Its done part time whilst the individual is working.

No one standards course
suits everyone!

Providing the human capital for the standards infrastructure of tomorrow

For standards organisations a dedicated standards degree would be beneficial, similar in a way to that taught in the Chinese example.

One possibility is that the European and national standards bodies could cooperate with a university in the delivery of such a course, and provide some of the teaching. Placements and internships could be done both in the student's home country standards body or, e.g., CEN/CENELEC/ETSI.

The aim would be that graduates from this degree would work in all of the national standards organisations as well as the EU ones and even non-EU standards bodies.

Such a course would be multidisciplinary, giving graduates insights into a whole range of subjects. They would not be engineers or economists or lawyers. Their focus would be standards, but they would understand the perspective of the engineer and have insights into the way the economy and legal system work.

Streams

Potentially, different streams for general standardization, accreditation, conformity assessment, metrology and market surveillance.

Potentially too joint degree options in aspects of engineering, pharmacy, biology, the law and so on.

Having all this done in one place would ensure that throughout the EU. standards are implemented in a consistent manner.

The social networks that graduates would develop, would also be an advantage to them throughout their career.

Of course in the EU there are standards courses in university degrees and even standards degrees such as the Masters in Standardization, Social Regulation and Sustainable Development at the University of Geneva.

But there is need for an education aimed at providing the human capital for the standards infrastructure of tomorrow for the whole of the EU.

An education that is fully targeted at the uniqueness of the standardization discipline.

There are precedents, e.g. the French École nationale d'administration focuses on the training of senior public officials.

Educating the managers of tomorrow

They need to be aware of standards, although not themselves developing them or engaged in standardisation.

For them, a single standards course would be more relevant.

This should be an option in management schools, more so than today.

Not all managers would need to do this.

But an awareness of standards by some within a firm would be an advantage.

Teaching standardisation at Matej Bel University

Included in our degree to our masters students is a course on standards, which has run for the first time in 2016/2017

- **Study program:** Finance, banking and investment
- **Degree:** Master's degree
- **Recommended hours of teaching:** 39 hours

Outcomes: Student

will use the obtained theoretical knowledge for analysis of the standardisation issues on the national and international level. They will apply the knowledge to solving practical problems;

is able to evaluate the development of metrology, standardisation and regulatory policies on the level of state and region;

and evaluate and present the theoretical approaches and empirical findings from the area of standardisation within context of the Slovak economy and the EU and EMU.

Subject: Standardisation and international standards

Content

- 1) Introduction to standardisation
- 2) Standards, regulation, certification, accreditation and global markets.
- 3) Economics of standardisation
- 4) Standardisation and innovations
- 5) National legislative and institutional frameworks of standardisation
- 6) Market surveillance and the role of state
- 7) Standards and management of firms
- 8) International standardisation and international cooperation in the area of standardisation
- 9) Regulative measurements and standards in finance.
- 10) International trade, standards and regulation
- 11) Standardisation in the EU
- 12) International institutions in the area of standardisation
- 13) Political implications of standardisation

Educating 'the engineers' of tomorrow

They will need specialist knowledge in the area their firm or organisation is engaged in, e.g. IT, engineering, robotics. In this case a joint degree, 'engineering and standards', 'IT and standards', 'the environment and standards' might be a possibility. They will not need to know economics, although patent law is useful.

This would combine specialist standards courses with those in IT, engineering or the environment.

Hence there is a need for joint degrees involving standardization.

Such specialist degrees would also be relevant for those in the standards infrastructure, focusing on metrology, conformity assessment, market surveillance, etc.

Educating the working groups of tomorrow

- There is also a need for standards expertise amongst those who contribute to the Working groups and committees, i.e those groups of people who actually write standards.
- They are just as important for standards development as the full time professionals.
- To an extent these come from private organisations and academia.
- They will not need the expertise of the full time standards professional. But they do need, and often in a formal way do not have, a knowledge of legal aspects of standards, economics impacts of standards and the way committees work – and also how they do not work.
- All of this is probably a full year two semester course as an option within a business, engineering, science degree. etc.

Questions and problems which remain

- The exact composition of each type of course is for discussion.
- For someone seeking a career in market surveillance. There will be context specific skills relating to the nature of the market. But also more general skills.
- What are they?
- We need this skill mapping done for every specialisation in the standards infrastructure.

EURAS

- EURAS is primarily focused on standards education. But it provides a valuable network of contacts.
- have issued a White paper on the way forward for standardisation in Europe.
- The White paper is focused on education at all levels and amongst their recommendations are:

A European Standardisation Education Agency

An organisational infrastructure at the European level is needed consisting of a European Standardisation Education Agency and a steering group.

The agency should be funded by the EU Commission.

The Steering group responsibilities include:

promoting standardisation education,

- coordinating standardisation education activities in the EU member states
- developing a European Qualifications Framework for education in the field of standardisation (EQF-S).

Specifying:

- a standard period of study
- study objectives
- course contents
- forms of teaching and study
- an examinations system
- stimulating the inclusion of standardisation among the official terms that describe what students need to know when they leave school.
- giving guidance to the European Office for Standardisation Education

Agencies involved in these issues in Europe include

UNECE – START-ed Initiative – Geneva

EURAS – European Academy for Standardisation

European Commission - Directorate-General for Internal
Market, Industry, Entrepreneurship and SMEs

I mention the EURAS paper as an important contribution to the debate, but...

There is a lot we would like to teach in schools and we have limited time.

A European Standardisation Education Agency is not necessarily inconsistent with the ideas we have put forward in this presentation.

There are many things I have left out in this short time. Including whether some of this education is best done at masters or undergraduate level or both.

Finally, I titled this with 'the start to a discussion'. That discussion is badly needed.

And start with this perhaps, do we focus on education for market surveillance or education for standards as a whole?



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Thank you for your attention

