Skills gap analysis and competence based curricula through Erasmus - Good practice example

Erasmus 2010-2011: ECCE - Engineering observatory on Competence based Curricula for job Enhancement

INFO DAY FOR LIFELONG LEARNING PROGRAMME CENTRALISED ACTIVITIES IN SOUTH-EAST EUROPE REGION, Zagreb, Hotel Dubrovnik, 22 May 2012

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Partnership

- Fondazione Politecnico di Milano -
- ACET - E
- CEFI - FR
- DEKRA Academy-DE
- ELTE University - HU
- Mechanical Department-PoliMI-IT
- SEFI - BE
- Stuttgart University-DE
- University of Birmingham-UK

Reference data

ECCE span: 2 years (2010-2011);

LLP: Erasmus-ECUE-Multilateral projects.

The ECCE project objective

Engineering Observatory on

- Permanent;
- Providing updated information;

Competence Based Curricula

- Engineering Higher Education;
- Shift to competences (learning outcomes);

- Erasmus – Cooperation between Universities and Enterprises project;
- Selection 2009.

for Job Enhancement

- Labour market / Enterprises;
- Improvement of conditions of future workers.

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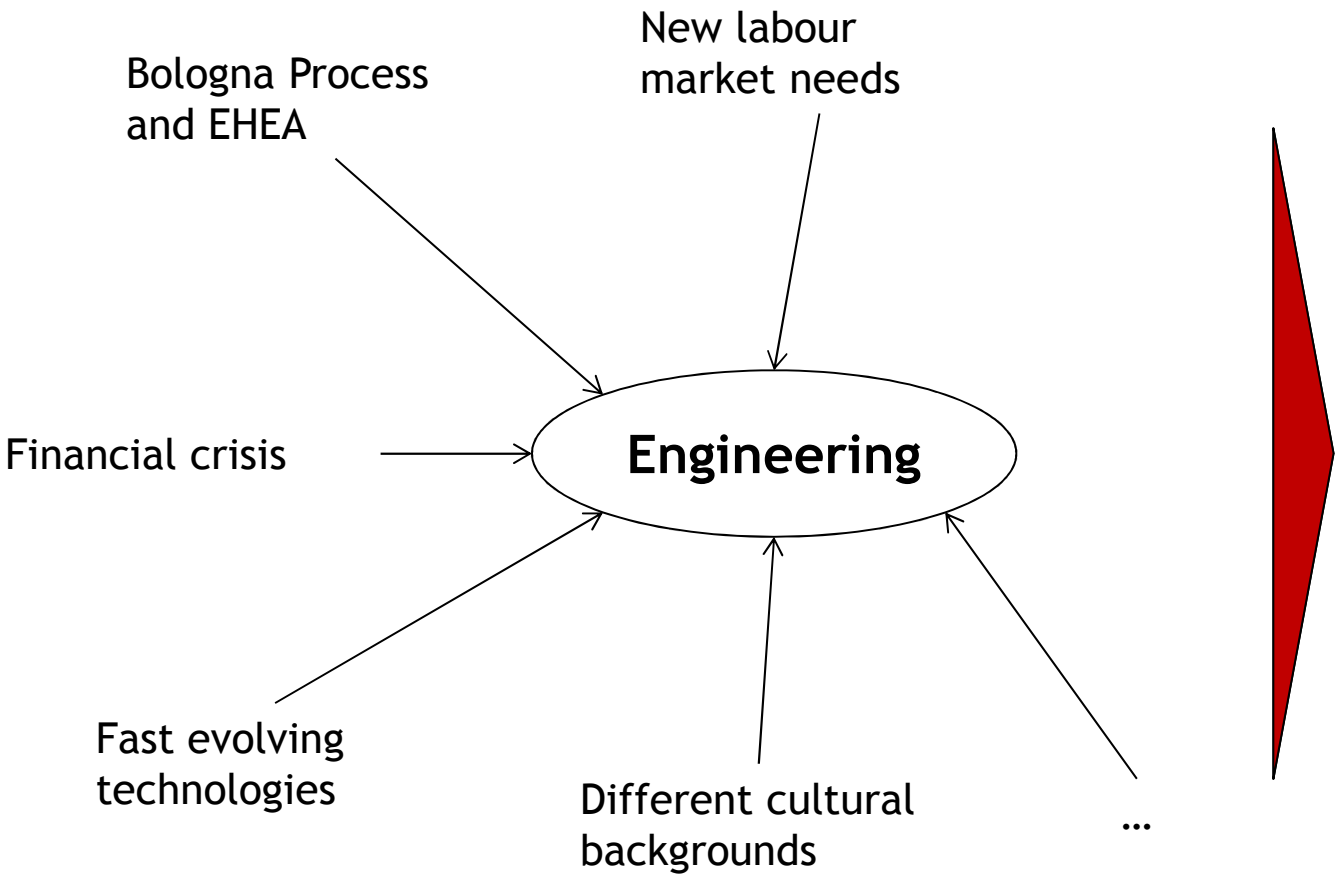
WHY: under pressure…



How to provide better employment conditions, increase of workers' mobility, competences growth?

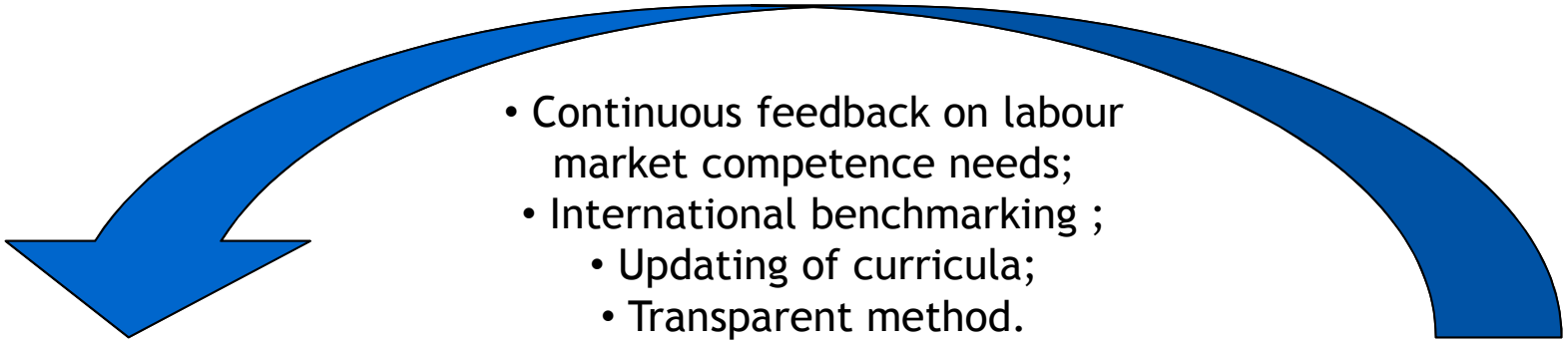
Three main areas of activity

Continuous skill watching on labour market needs (with reference to engineering education) by surveys and focus groups;

“Translation” of these needs into transparent learning outcomes (using the EQF);

Providing a reference model for Universities, Enterprises, Stakeholders involved in the process of curricula adjustment.

ECCE cycle



List of Learning Outcomes

- Shift to LO (at programme level) as “bridge” between HE and Enterprises;
- **EQF** as reference tool to position LOs from the experience of **DOCET** (Erasmus Mundus Project);
- **EURACE** as reference to pick up content.

Questionnaires

- Shared and open model, **implemented in several European countries;**
- Online survey for Alumni / Professionals;
- **Focus groups** and **business meetings** with Universities and Enterprises.

Gap analysis

- Collection of data;
- New focus on cooperation mechanism Universities/Enterprises.

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Learning Outcomes embedded in surveys

- LO identification: - from **EUR-ACE,** - General learning outcomes (all engineering disciplines covered) + specific learning outcomes (related to specific engineering branches);
- Framework Standards and dimensions : - from EQF, - already identified in previous projects such as **DOCET** (ex. Action Verbs, Context descriptors, Levels of Autonomy and Responsibility); in particular:

DOCET is a reference on how positioning LOs onto EQF; EURACE is a reference for content.

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Example of learning outcomes *(from EURACE)* 1/3

LO category	Learning outcomes
Knowledge & Understanding I	Knowledge & understanding of the scientific/mathematical principles underlying your chosen area of engineering.
II	In depth knowledge & understanding of the specific principles of your branch of engineering.
III	In depth knowledge & understanding of the specific principles of your branch of engineering, some of them at the forefront of academic knowledge / cutting edge
IV	Awareness of the wider, multidisciplinary, context of your branch of engineering, and how it fits into other industrial functions and subjects.
Engineering Analysis I	Identify, formulate and solve engineering problems applying relevant problem solving methodologies.
II	Identify, formulate and solve complex engineering problems (i.e. new, not completely defined, with competing specifications, etc.), and applying or developing innovative problem-solving techniques.
III	Analyse and conceptualise products, processes or systems, in particular in your chosen area of engineering.

Example of learning outcomes *(from EURACE)* 2/3

LO category	Learning outcomes
Engineering Design I II	Understanding of design methodologies and ability to use them to develop original solutions to engineering problems, including unfamiliar problems, to meet specified requirements. Ability to use design methodologies in a creative or innovative way to develop original solutions to multidisciplinary (not just to engineering) problems, including unfamiliar ones, and which may not be clearly defined.
Investigation I	Ability to utilise a wide range of sources of information, also considering new and emerging technologies in your chosen branch of engineering, and critically evaluating your findings to solve problems.
Investigation II	Ability to design and conduct experimental investigations, critically interpreting the results.
Engineering Practice I II	Ability to understand, select and use appropriate equipment, tools and methods to handle engineering problems/activities. Comprehensive understanding of applicable techniques and methods, together with the limitations of these techniques.

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Example of learning outcomes *(from EURACE)* 3/3

LO category	Learning outcomes
Management and Sustainability I	Ability to evaluate the economic implications of different engineering solutions.
II	Ability to apply project management techniques to handle engineering activities and projects.
III	Ability to apply risk assessment techniques to handle engineering activities and projects.
IV	Ability to evaluate the environmental implications of different engineering solutions.
V	Ability to evaluate the social implications of different engineering solutions.
VI	Awareness of legal, health and safety issues (and any corresponding standards).
Soft Skills I	Awareness of ethical issues.
II	Work and communicate effectively in national contexts.
III	Work and communicate effectively in international contexts.
IV	Function effectively as member of a (multidisciplinary) team, taking responsibility for decisions, where required.
V	Recognise the need for, and have the ability to engage in independent, life-long learning.

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Method of learning outcome positioning (*from DOCET*)

Main EQF Dimensions: Context complexity / Action verbs / level of autonomy.

Learning outcomes: Skills

- Identify, formulate and solve complex engineering problems (i.e. new, not completely defined, with competing specifications, etc.), and apply or *develop* innovative problem solving techniques. EQF Level 6
- Use design methodologies in a creative or innovative way to develop original solutions to multidisciplinary (not just to engineering) problems, including unfamiliar ones, and which may not be clearly defined. EQF level 7

Learning outcomes: Competences

- Apply project management techniques to handle engineering activities and projects. EQF level 6
- Evaluate the social implications of different engineering solutions.

EQF level 7

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Example of learning outcome positioning 1/2

EQF-Level	Knowledge (theoretical and/ or factual)	Skills (cognitive and practical)	Competence (responsibility and autonomy)
6	advanced knowledge of a field ofwork or study, involving a critical understanding of theories and principles	advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study	- manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts take responsibility for managing professional development of individuals and groups
	ECCE learning outcomes:		
	Knowledge & Understanding I Knowledge & Understanding IV	Engineering Analysis II Engineering Practice II Engineering Analysis III Engineering Design I	Management and Sustainability II Management and Sustainability III Management and Sustainability VI Soft Skills I Soft Skills II Soft Skills V

Example of learning outcome positioning 2/2

EQF-Level	Knowledge (theoretical and/ or factual)	Skills (cognitive and practical)	Competence (responsibility and autonomy)
7	- highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research - critical awareness of knowledge issues in a field and at the interface between different fields	specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields	- manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches - take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams
		ECCE Learning outcomes:	
	Knowledge & Understanding II Knowledge & Understanding III	Engineering Design II Investigation I Investigation II	Management and Sustainability I Management and Sustainability IV Management and Sustainability V Soft Skills III Soft Skills IV

Questionnaires (1/2)

- Survey to alumni;
- Collection of following information:
  - ➢personal data;
  - ➢current job position and working experience;
  - ➢skill/gap analysis;
  - ➢how to improve engineering education (suggestions).

Level of mastery:
- they had at the end of their engineering studies;
- they would have liked to reach at the end of their studies;
- required to comply with the needs of their current job.

Questionnaires (2/2)

- Survey addressed to Universities and Enterprises mainly by focus groups at local level;
- Collection of following information:
  - Personal data;
  - Organisational data;
  - Skill gaps analysis (general and specific);
  - Additional information (on method to implement LOs).

Activities

- Analysis of data;
- Consolidation of the model;
- Focus groups and business meeting with companies;
- Enlargement of network (…join us!);
- Conferences and Publications.

Skill watching: the example from Italy

•Target of the survey: alumni of Mechanical Engineering Courses at Politecnico di Milano.

• Selection of competences :
  • Required by enterprises;
  • Developed by University;

Through local focus groups with ASSOLOMBARDA and its associated companies and Professors, partner of the project and from Universities of Florence and Naples.

• Online survey to Alumni / Professionals.

• Collection of data about alumni perceptions:
  ➢Level of mastery reached at the end of their engineering studies;
  ➢Level of mastery required by their job.

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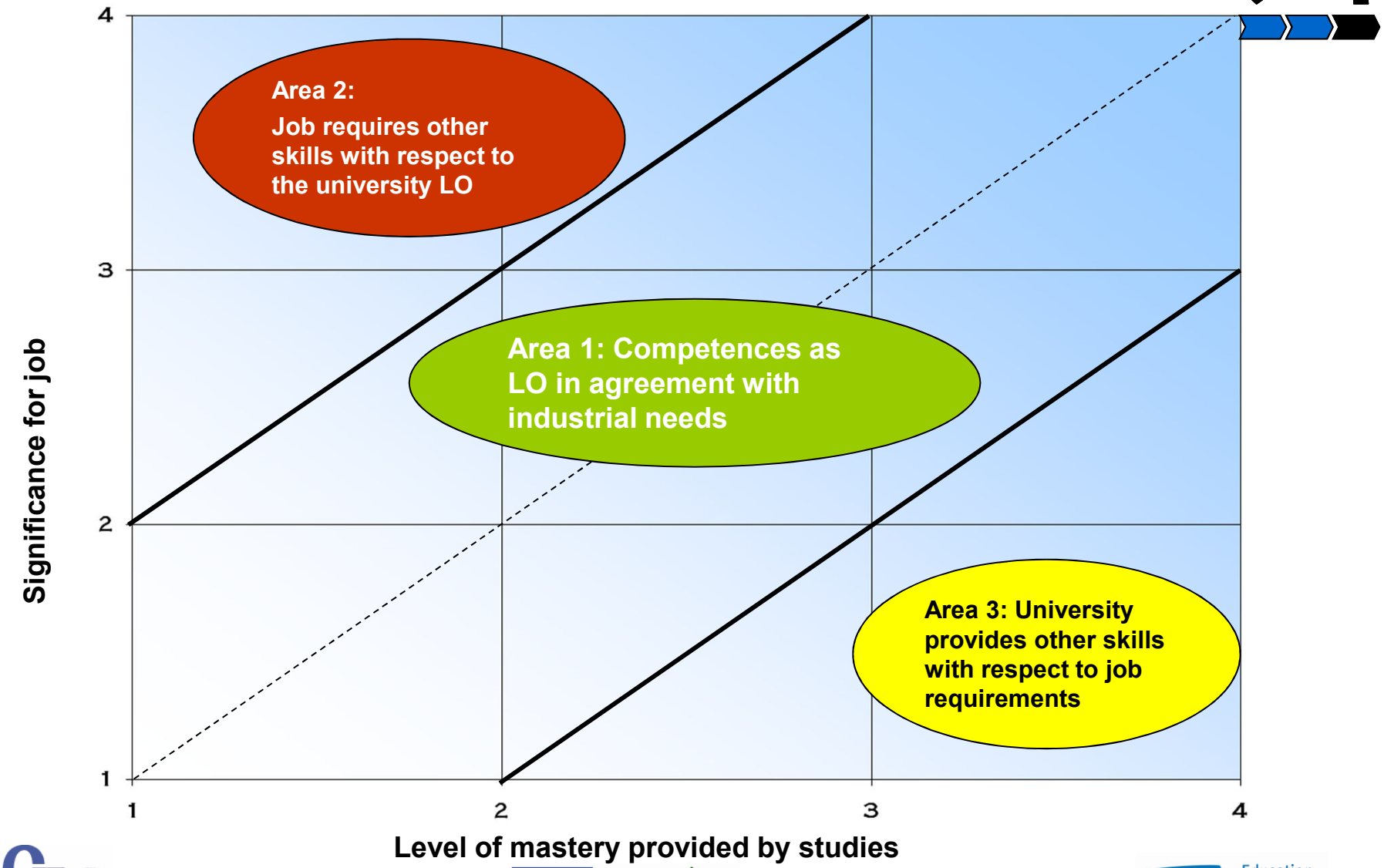
The mapping of results (from Italy)



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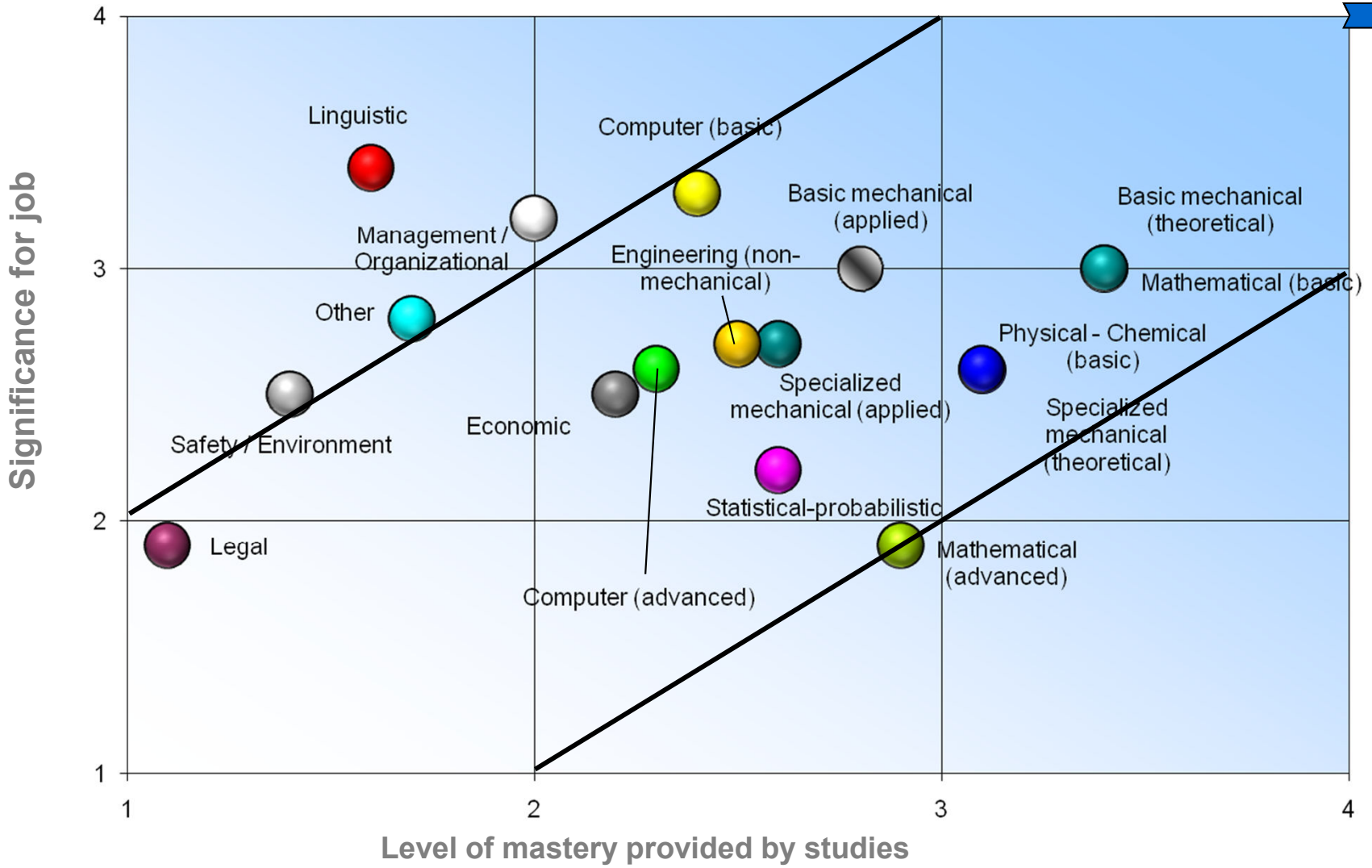
Results (1/3) (from Italy)



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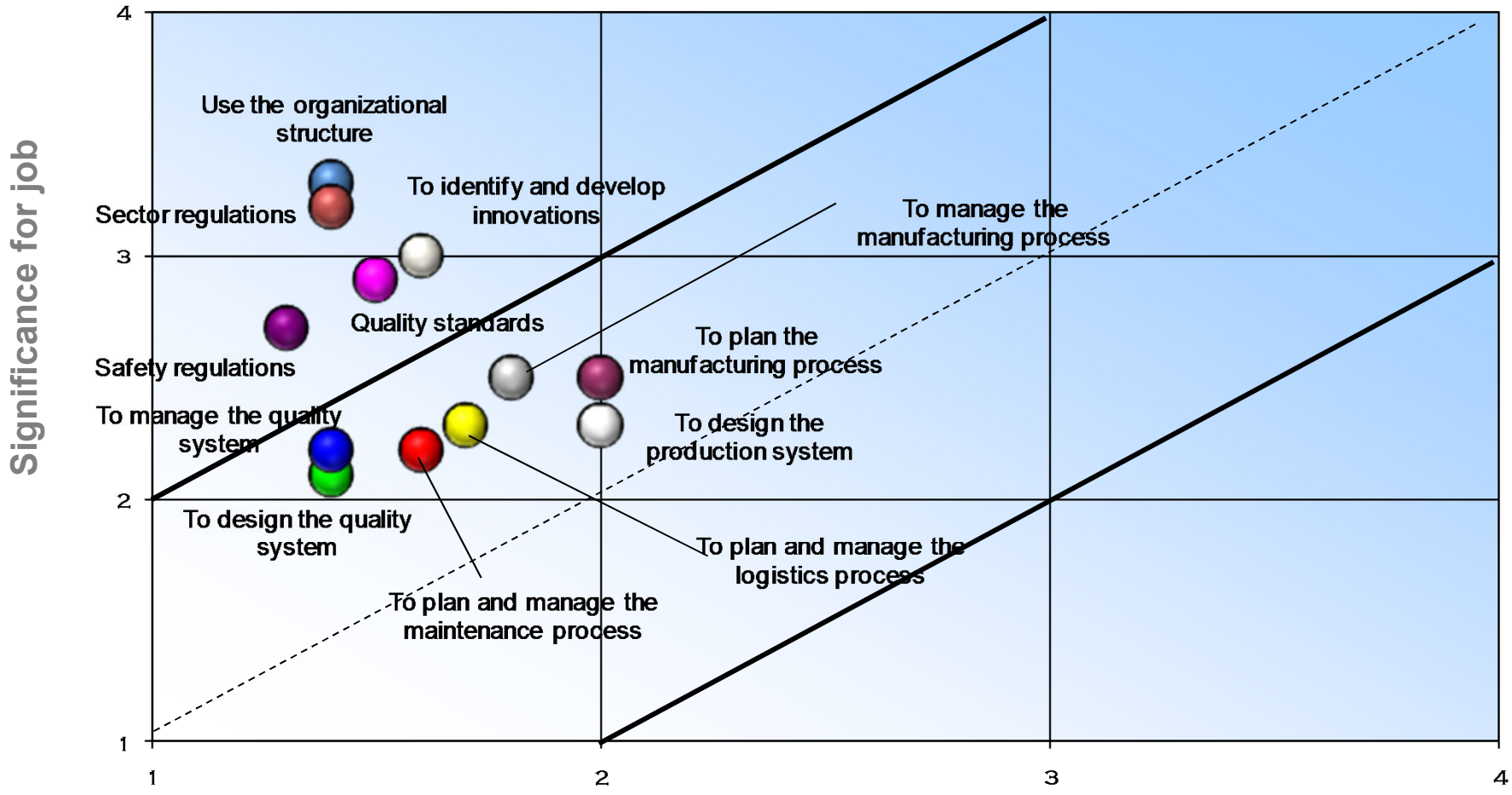
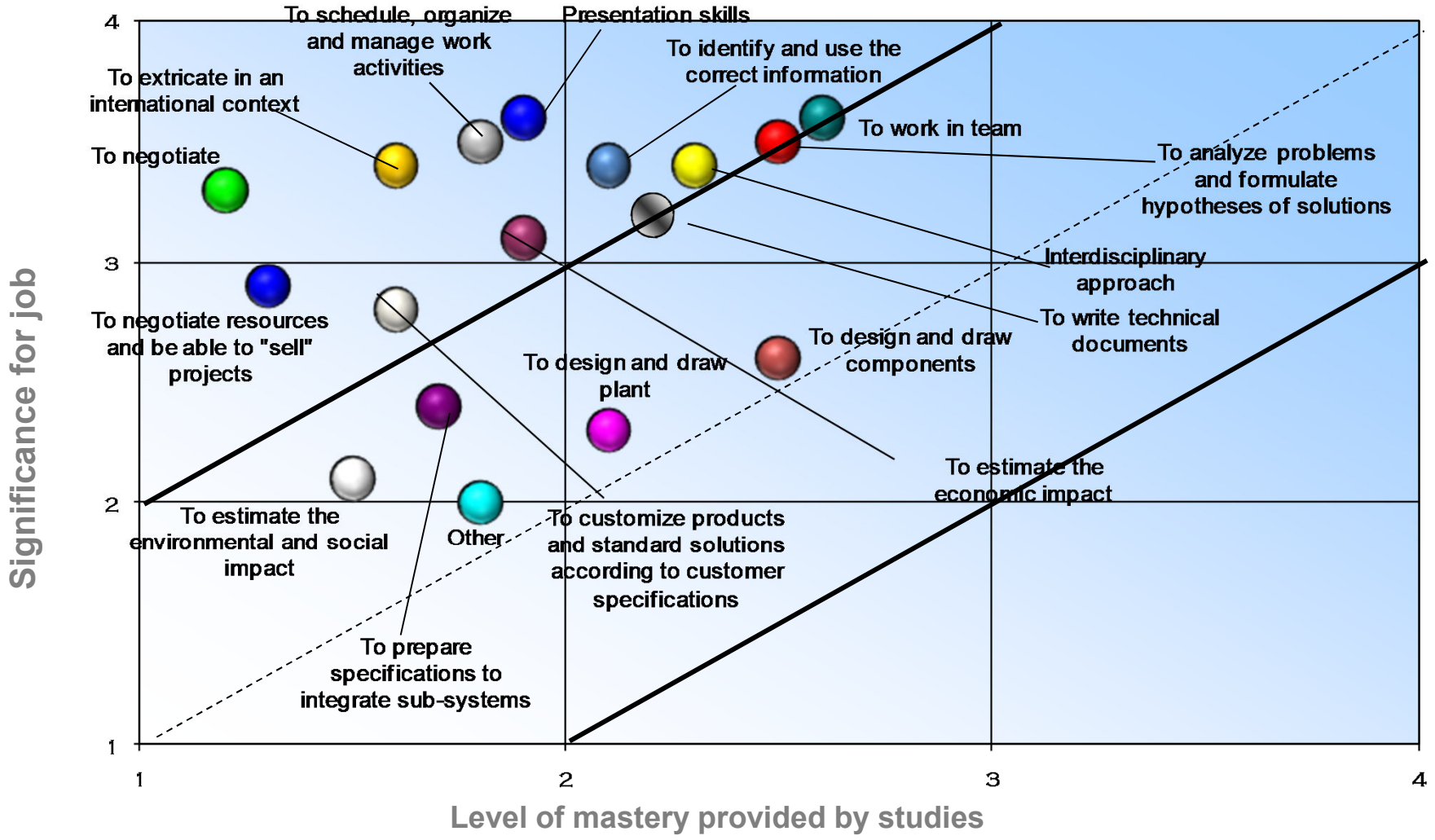
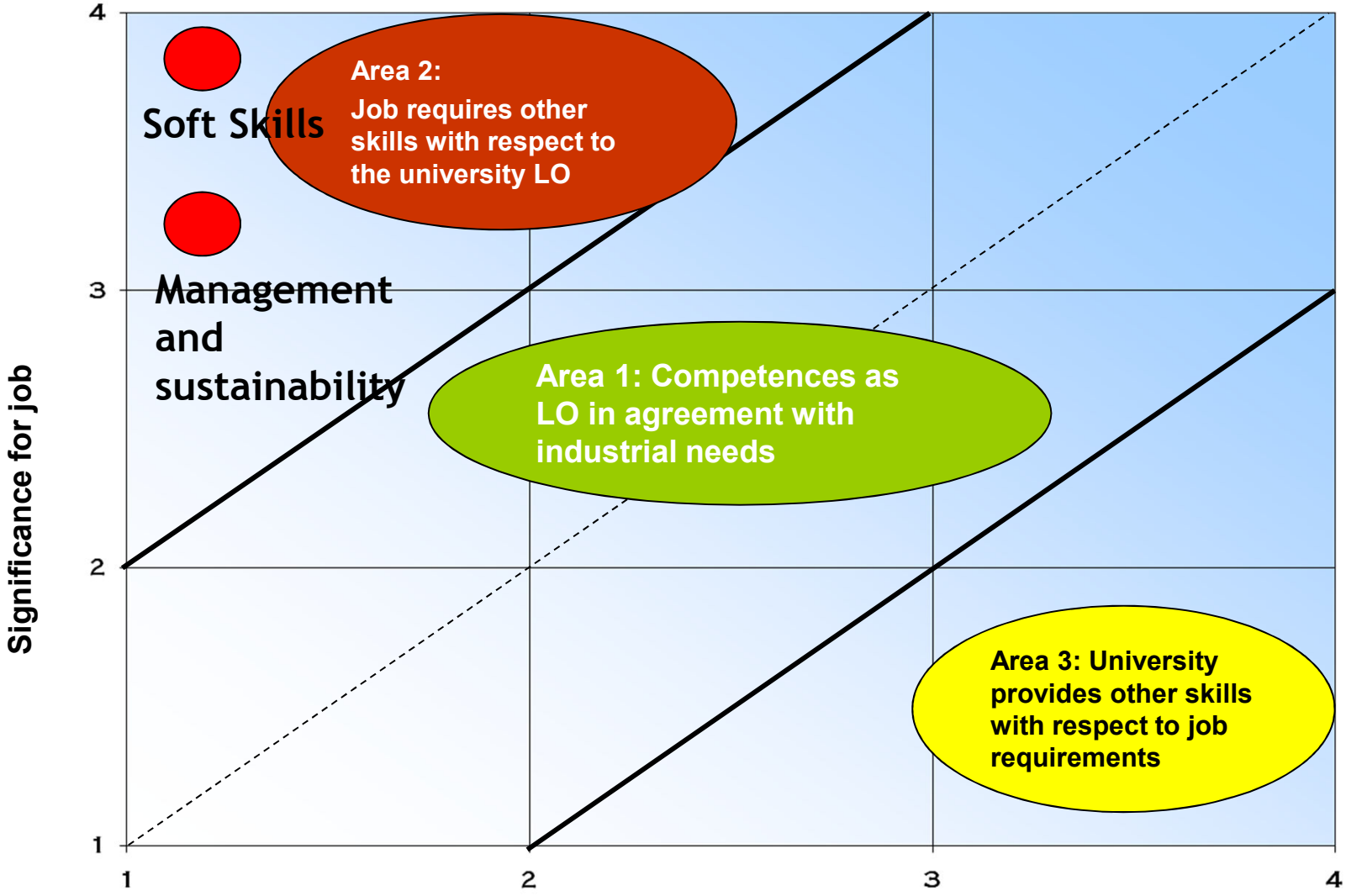
Results (2/3) (from Italy)



Results (3/3) (from Italy)

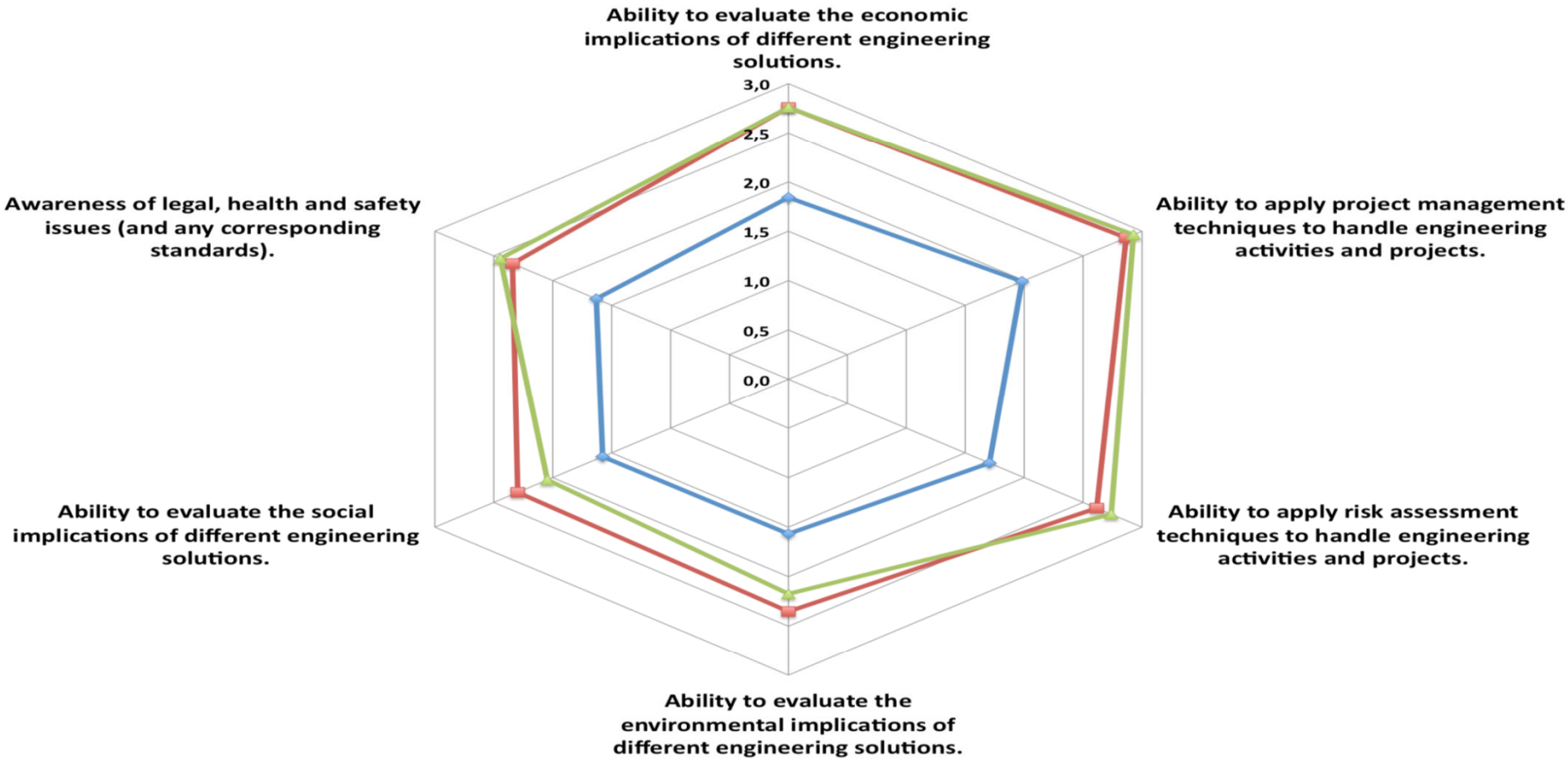


Common results in brief 1/2



Common results in brief 2/2

Management and sustainability



ECCE results in brief

Soft – managerial skills are quite critical; Universities's and Enterprises' perceptions often diverge – list of detected weak competence areas;

Standardized questionnaires ready to be used for surveys to Alumni, Enterprises, Universities;

A shared method assigning EQF levels to Learning Outcomes.

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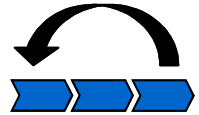
ECCE main critical points and lesson learned



University - Enterprise relationships / local barriers due to spoken languages;

Speaking a common technical language based on learning outcomes: *EURACE helped*;

EQF interpretation and agreement on the EQF levels: *DOCET project helped*.

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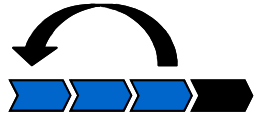
ECCE ongoing activities from FPM and POLIMI

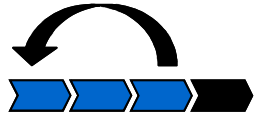


Pilot accreditation based on EURACE (Politecnico di Milano);

Local surveys to Alumni, and focus groups with Enterprises, Universities

The shared method assigning EQF levels to Learning Outcomes is applied to other contexts (e.g professional standards and competence certification / VET skill assessments)

Next steps beyond the project



Developing a model of governance to sustain ECCE and the relationships within the knowledge triangle (innovation, research and education) over time, sustaining the international observatory ;

Focusing on pedagogic and didactical methods;

Focusing on LOs assessment.

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Thank you!

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