EIE · SURVEYOR

reference point for
Electrical and Information Engineering in Europe

The alignment of GENERIC, SPECIFIC and LANGUAGE SKILLS within the ELECTRICAL AND INFORMATION ENGINEERING discipline

Application of the TUNING approach

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EIE Surveyor Project

Final Report for Task on:

The alignment of generic, specific and language skills within the Electrical and Information Engineering discipline, Application of the TUNING approach

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Executive Summary

Task 1.1 of the EIE-Surveyor project has been dedicated to the application of the Tuning Methodology to the Electrical and Information Engineering discipline area. This report presents the approach taken to this application and an analysis of the results obtained from a pan-European survey of students, academics, graduates and employers. In total 3,275 completed questionnaires have been received and entered into a single SPSS dataset. The responses have enabled analyses in a number of different ways to be carried out including comparisons by gender, academic study level, country and by competence both individually and in groups they form through the application of standard statistical data reduction techniques. Attention has been paid to the clarification of the scope of the EIE area as the boundaries between technical degrees and broader arts degrees are blurred in places.

The project has confirmed the appropriateness of the Tuning Methodology to the discipline area and, in line with other Tuning studies, has shown that the results do differ between countries and that clustering of countries does occur in some analyses.

The analysis shows that, in terms of general preparedness for employment academic typically over-rate while students generally under-rate their view on how well they are preparing students relative to employers. This perhaps reflects a general optimism of employment potential by academics and pessimism by students. In general employers and academics rate competences higher in importance than students and graduates, even allowing for the unevenness in the average responses of these different stakeholders. The most important generic competence is problem solving followed by elementary computing skills and knowledge of a second language. A number of differences between rated importance and level of development of the competences emerge providing evidence that adjustment of curricula would be beneficial. Finally the analysis shows that the English language is the only second language that is rated as anything more than weakly important. This view is shared by all stakeholder groups.

The value of the Tuning Methodology and of the analyses carried out has been demonstrated by this project task and the specific findings point clearly to areas where more work can be undertaken. There are gaps in the data for some countries and for some stakeholder groups within some countries. It is recommended that attempts are made to fill these gaps so that the analysis can be extended to be more representative of the whole of Europe. The issue of clustering needs to be examined in more detail and a focussed study in this area may reveal some interesting European country clusters or some regional differences.

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1. Introduction

The Electrical and Information Engineering (EIE) discipline area has been the focus of attention for the European Association for Education in Electrical and Information Engineering (EAEEIE) since its inception 20 years ago. As an Association, it dedicates itself to all matters relating to education at the Higher Education level, in the EIE area. Since 1996 it has successfully won a series of European Union Thematic Network projects to investigate aspects of EIE education and to share and disseminate findings and best practice.

This report is the final report of one task, Task 1.1, of the current EAEEIE Thematic Network project called EIE-Surveyor. The project task and hence this report, addresses the alignment of the competences developed in students across Europe as part of academic programmes in the EIE area to the demand for graduates.

By way of introduction, this section starts with a brief introduction to the EAEEIE, the EIE-Surveyor project and to Task 1.1, to the Tuning Methodology, which underpins the methodology used in this project. The special issues associated with the EIE area are also discussed in this section together with an overview of the structure and contents of this report.

1.1 The European Association for Education in Electrical and Information Engineering

The European Association for Education in Electrical and Information Engineering (EAEEIE) is permanently working for the progressive development of higher education in the field of electrical and information engineering. During the last decade it has been trying to support and contribute to the process of harmonization of higher education across Europe. The main effort is to pull together the most significant players in HE – the universities. In this respect the main working method of the EAEEIE is the creation of wide networks of universities and other relevant partners (especially from industry) and to focus their creative potential for the solution of the contemporary problems of education in the field of EIE.

In this respect it is worth mentioning the most significant projects it has led during the past few years:

1. INEIT-MUCON (1996-2000) – EU funded thematic network which stands for “Innovation for Education in Information Technology through Multimedia and Communication Networks“. The main idea consisted of developing some pedagogical resources and experimenting with them using examples from the following topics: Theoretical Electrical Engineering, Communications Technology, Power Systems, Computers, Sensors and Electronics. The INEIT-MUCON project included about fifty partner institutions in Higher Education from all over Europe. It was financed by these institutions and the European Commission within the framework of the SOCRATES Thematic Network programme. Within this project, six Thematic Network Packages (TNPs) were created. Co-operation between lecturers from many universities in Europe was established and maintained for the future. The Thematic Network Packages was supervised by academic staff and partially implemented by potential end-users, the students, within the student exchange programme between universities. Most of the TNPs were implemented in more than one language, to facilitate their dissemination in a multi-cultural environment. This educational material was made available on the web site of the EAEEIE and was at the disposal of all institutions, academic staff and students free of charge.

2. THEIERE (2000-05) – “Thematic Harmonisation in Electrical and Information EngineeRing in Europe” was also an EU funded network project. About 100 universities and other relevant partners were grouped together in the network. Among the main activities and results of the project was: a monograph containing a survey and analysis of EIE education at a European level, concerning organization, pedagogical issues, new pedagogical tools, and main trends in education systems in EIE; teaching packages in the form of short courses available via internet or on CD-ROM; a site for each of the participating leading site partners, with links to the TN packages already developed and links giving access to sites of professional engineering associations and networks.

THEIERE was followed by the current Thematic Network project, EIE_Surveyor.

1.2 The EIE-Surveyor Project

3. EIE-Surveyor: Reference point for Electrical and Information Engineering in Europe – EU funded thematic network (2006-2008). This, current, project has more than 110 HE partners. The main objectives of the project are:

1 Reflection on generic competences and subject-specific competences in Electrical and Information Engineering (EIE)

2 Implementation of quality assessment on some educational resources available in EIE

3 Reflection and proposition of a methodology for accreditation, in order to enhance comparability and common certification procedures

4 Proposition of a census of the existing curricula in EIE in Europe, the multinational degrees, and the situation of the implementation of the Bologna-process in our fields, at the bachelor, master and PhD levels.

As indicated above one of the EIE-Surveyor main activities is the application of the TUNING methodology to EIE, which will result in an improved understanding of the subject-specific competences in EIE.

1.3 The Tuning Methodology

In this paper we concentrate on the explanation of the basic principles of the Tuning methodology and on the application of these principles to the field of EIE.

The background and context of the Tuning project is the implementation of the Bologna Process at university level [1]. The project aims to make study programmes comparable and compatible. The Tuning project proposes output-oriented programmes based on learning outcomes expressed in terms of generic and subject-generic competences as well as on ECTS workload-based credits. The Tuning project focuses not on educational systems, but on educational structures and content of studies. As a result of the Bologna declaration the educational systems in most European countries are in the process of reformation. This is the direct effect of the political decision to achieve convergence of the different national education systems in Europe. For HE institutions these reforms in their turn constitute the starting point for another discussion – about tuning the curricula in terms of structured degree programmes and approaches to teaching and assessment. The Tuning project aims at identifying reference points for generic and subject-specific competences for the first and second cycle graduates in a series of subject areas. At first it was accomplished in a group of subject areas like Business Administration, Chemistry and Earth sciences.

The name of the project “Tuning” has been chosen in order to express the idea that universities are not attempting the harmonization of their degree programmes or planning to implement any sort of unified, prescriptive or definitive European curricula. They are rather interested in establishing reference points and encouraging convergence and common understanding.

According to the Tuning methodology attention is devoted to the concept of profile. A degree profile should be based on a process of consultation with the most significant stakeholders for the degree programme. These stakeholders are not only academics and students but also graduates, employers and professional organizations. The latter three groups represent an important link to the needs of society. Formal university bodies as well as the academic faculty involved must ultimately be responsible for the realization of each programme.

In the framework of the Tuning project a methodology has been designed to understand curricula and to make them comparable. Five lines of approach have been distinguished to organize the discussions in the subject areas:

- generic (general academic) competences
- subject-specific competences
- the role of ECTS as an accumulation system
- approaches to learning, teaching, and assessment and
- the role of quality enhancement in the educational process (emphasizing systems based on internal institutional quality culture).

In the first phase of the Tuning project the emphasis was on the first three lines. The fourth and fifth lines received less attention due to time constraints, but they had a central place in the second phase of the project (2003-2004).

During the first phase of the Tuning project definitions of the terms "profile", "learning outcomes", and "competences" were formulated in order to ensure clarity and coherence. The definitions adopted were developed further during the second phase of the project. A clear distinction was made between the "learning outcomes" and "competences".

The introduction of a two or three cycle system makes it necessary to revise all existing study programmes which are not based on the concept of cycles. In practice these programmes have to be redesigned because in a cycle system each cycle should be seen as an entity in itself. The first two cycles should not only give access to the following cycle but also to the labour market. This shows the relevance of using the concept of competences as a basis for learning outcomes.

Tuning makes the distinction between learning outcomes and competences to distinguish the different roles of the most relevant players: academic staff and students/learners. Desired learning outcomes of a process of learning are formulated by the academic staff, preferably involving student representatives in the process, on the basis of input of internal and external stakeholders. Competences are obtained or developed during the process of learning by the student/learner. In other words:

Learning outcomes are statements of what a learner is expected to know, understand and/or be able to demonstrate after completion of learning. They can refer to a single course unit or module or else to a period of studies, for example, a first or a second cycle programme. Learning outcomes specify the requirements for award of credit.

Competences represent a dynamic combination of knowledge, understanding, skills and abilities. Fostering competences is the object of educational programmes. Competences will be formed in various course units and assessed at different stages.

Competences can be distinguished between subject specific and generic ones. Although Tuning acknowledges to the full the importance of building-up and developing subject specific knowledge and skills as the basis for university degree programmes, it has highlighted the fact that time and attention should also be devoted to the development of generic competences or transferable skills. This last component is becoming more and more relevant for preparing students well for their future role in society in terms of employability and citizenship.

Tuning distinguishes three types of generic competences:

- Instrumental competences: cognitive abilities, methodological abilities, technological abilities and linguistic abilities;
- Interpersonal competences: individual abilities like social skills (social interaction and co-operation);
- Systemic competences: abilities and skills concerning whole systems (combination of understanding, sensibility and knowledge; prior acquisition of instrumental and interpersonal competences required).

Subject specific competences are the competences required for the discipline or profession that the programmes have been designed for and embrace the technical domain of the subject area.

1.4 Task 1.1 – The Tuning Methodology applied to the EIE area

The objective of the application of the Tuning Methodology to the EIE discipline area was to explore the alignment of the competences of the EIE graduate with employers as the users of the end product of study programmes; of academics who are instrumental in the design of the curricula; and students as 'customers' of the programmes. The views of graduates were also sought as a link between students and employers.

True to the ethos of the Tuning Methodology two main sets of competences were explored, the generic (general academic) competences and subject specific competences. In addition to these a third set was added, language competences, to explore in more detail one of Tuning's generic competences, that of "Knowledge of a second language".

In the early days of the project, and as a consequence of the EIE Monograph output of the THEIERE project an issue emerged – how is the EIE discipline area bounded? This question is addressed next.

1.5 The Electrical and Information Engineering area as a discipline

The titles Electrical and Information Engineering are broad and somewhat 'fuzzy' terms. As was found in the creation of the first cycle degree programme monograph, there are many different academic programmes that clearly fall within common understanding of the terms and many that lie at its boundary. For the purposes of this project the definition of EIE has been aligned with the EIE Surveyor monograph definition which is encapsulated in a set of degree programme titles. These embrace Electrical and Electronic Engineering as would be expected. They embrace Information Engineering where it is of an electronic or computer science nature, and Computer Science. Excluded would be information engineering where it is directly and predominantly orientated towards information in the media (news, television, etc.)

Subjects such as Media Technology, Communications (again where electronic in nature), Control, Aerospace, Mechatronics, and so on are included where the electrical or electronic technical content predominates. Subjects such as Business Management are included where it is a minor component (typically 25% or less) of a technical degree.

The broadness of the discipline introduces the potential problems of comparing engineering subjects with more science (Computer Science) orientated subjects. This aspect is not included in this report but could be the subject of a more focussed study on the overall dataset in the future.

1.6 Report structure

Section 2 explains the research methodology adopted in this project and describes the questionnaires used. It concludes with some of the research questions that were initially set for the survey. The following four sections then look at the responses of each respondent group starting with students, then academics, employers and finally graduates. In each section the response of the general overview questions and the more detailed questions on importance and level of development of the generic language and specific competences are considered in turn.

For brevity in the main body of the report tables have been shortened to show the top and bottom 5 of any ranked list, the full ranked list of 32 in the case of the generic competences and 28 for the specific competences are given in Appendix 1. Additional tables associated with the analysis are also moved to the appendix. Finally tables of the numerical data supporting graphs in the main body are also included in Appendix 1 so the detail is present for those interested. To facilitate finding specific information in Appendix 1 a very intentional figure and table numbering system has been used. In the report figures and tables are numbered sequentially in combination. That is, if the first to appear in a section is figure 1 and the next is a table, the table will have the reference table 2. In the appendix the tabulated data supporting figure 1 will be table 1 and the full version of table 2 will be table 2. Any additional tables included, such as individual country tables are included as table x(a), etc. This convention ensures that the data supporting any main body figure or table can be found simply in Appendix 1.

Section 8 looks are the supply demand balance by considering all the results and data presented in sections 4 to 7. This section is the heart of the report and the section upon which most of the conclusions and recommendations, Section 9, are based.

For reference the full questionnaires are included in Appendix 2.

2. Research Methodology

2.1 Introduction

The general process followed in this task was to produce an initial set of questions, create a set of pilot questionnaires, carry out a small pilot study, make appropriate modifications and then launch the full survey. This section describes this process in more detail and explains the rationale to the approach at each stage.

2.2 Initial question sets

From the Tuning Methodology report it was clear that a set of the generic competences had been developed and used consistently across the studies carried out prior to the Surveyor project. The set of generic competences (32 in total) was discussed for applicability to the EIE area by the task team and it was agreed they should be used unchanged. Space was, however, added for additional competences respondents view as important as they complete the questionnaire.

The specific competences used in Tuning are different for each discipline and a set was required for the EIE area. Just prior to the start of the EIE Surveyor project various activities had been undertaken in the UK to define sets of output standard statements for engineers as a whole. The Engineering Council set of statements (28 in total) was used as the list for this project, they were general enough in nature to allow respondents to apply them to their own subject within the breadth of the EIE area.

The new set of competences, languages, was debated and was finally agreed to be the main language of each European country. Space was left for respondents to add additional countries important for them.

In all cases the Tuning Methodology approach of using a 4-point Likert scale for the importance and level of development of each competence was retained. In the case of the languages respondents were asked to state their perception of the importance and level of development of written and spoken ability in each language (4 responses per language).

To illustrate, the first generic competence is “Capacity for analysis and synthesis”. Respondents were asked to rate how important this is to them on a 4-point scale where 1 represents “none’, 2 “weak”, 3 “considerable” and 4 “strong”. They were then asked to indicate how well they feel “Capacity for analysis and synthesis” is being developed in their degree programme, also on a 1 to 4 scale with exactly the same meaning for each response number. The responses could only be 1, 2, 3 or 4.

A set of general questions were asked of all respondents to capture their gender, age band, position in the organisation, country, etc.

Four different questionnaires were created, one for students, one for academics, one for graduates and one for employers. The wording in each questionnaire was adjusted to make the whole questionnaire appropriate to the ‘stakeholder’ and to capture the important general information about them. Information not relevant to a particular stakeholder was removed to avoid confusion. For example, employers were not asked what level of study they are currently in (a student question) but they were asked to complete the questionnaire for one specific level (Bachelor, Master, Doctoral) and to identify the level. In this way comparative datasets should result.

The initial questionnaires were tested in a small number of institutions on a small sample to test the logic, instructions and wording and to assess the completion time.

2.3 Questionnaire optimisation and delivery methods

Following the pilot study changes were made to the wording to improve clarity and ease of completion. The time for completion was considered long but, other than removing questions from the list there were limited opportunities to reduce it and the decision was taken to progress to the main survey.

A number of questionnaire delivery mechanisms were proposed. An online website was created for direct electronic entry. Electronic versions of the questionnaire were created for sending to potential respondents by email and finally paper versions were made available. There was some debate over whether paper versions should be produced. It was agreed that there would be a trade off between response rate and the

collection method and that a difference method would suit different collection approaches. For maximum flexibility all collections methods were offered.

In the final form each questionnaire starts with an introductory page containing a brief overview of the objective of the study and the questionnaire and who the supporting body is (EIE-Surveyor funded by the EU). It then makes a statement about confidentiality and data protection and gives a name and contact details for more information. Finally there is a general instruction on how to complete the questionnaire.

The questionnaires are divided into four sections:

1. Background information

The background information section captures information about the respondent's institution; the country they are in; gender; age (in bands); and some additional pieces of general information such as the degree programme and year of study for students, etc. There are two general questions at the end of this section that ask how the respondent feels the education they received prepares or prepared them for employment and how they rate their employment prospects.

2. Generic competences

32 generic competences are identified for which the respondent is asked to rank, one a 4 point Likert scale (none .. strong) how they rate the importance of each competence and the level to which they feel it is developed. Space is provided for the respondent to add new generic skills if they wish. Finally they are asked to identify the five most important generic skills and rank them in order of importance.

3. Language skills

For every European language, the respondent is asked to rank the importance and level of development, as a compulsory part of their studies, of the written and spoken language, again on a 4 point Likert scale.

4. Specific competences

28 specific competences are identified for which the respondent is asked to rank, one a 4 point Likert scale (none .. strong) how they rate the importance of each competence and the level to which they feel it is developed. Space is provided for the respondent to add new specific skills if they wish. Finally they are asked to identify the five most important specific skills and rank them in order of importance.

It is anticipated that, with sufficient returned questionnaires, the correlation can be tested between students, faculty, graduates and employers for the same, or generically similar academic programmes to enable us to assess the fit of current provision to industrial need.

2.4 Data entry and analysis

Responses into the online website were collated into a set of Excel compatible spreadsheets. Paper and electronically completed responses were manually entered. All data were merged into a single SPSS data file. The responses for the different stakeholders being identified by a questionnaire code field. Each response was also given a unique reference code.

A code book defining all the variable names and attributes was designed for the data set before the SPSS data file was created and was then updated as the analysis was undertaken.

2.5 Research questions

The primary objective of this study is, in line with the Tuning methodology, to quantitatively assess the alignment of the supply and demand equation in the EIE discipline. Specific within this is the alignment of the generic and specific competences. In addition to these questions a number of subsidiary research questions will be addressed:

- Do the generic competences group to form meaningful and usable clusters?
- Do the specific competences group to form meaningful and usable clusters?
- How closely is the supply demand equation met as far as language skills are concerned?
- How well aligned are the perceived most important skills between the four respondent groups?

The primary research questions and the above subsidiary ones will be tested using a combination of descriptive statistical methods, factor analysis and correlation tests.

As might be expected from a study of the complexity of this one, the analysis that has been undertaken has led to many more possible questions being asked of the data set. It is expected that the analysis will be an ongoing activity for the EAEEIE as might the collection of additional data to fill in some of the gaps in the data set as it currently stands. This report should, therefore be read not as the last and final analysis of the task but as a summary of the findings and analysis undertaken up to the end of the project funding period.

3. Overall data set

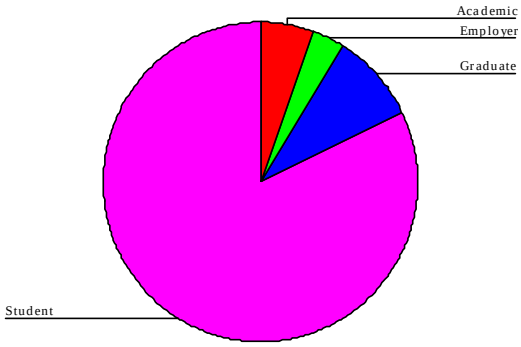
3.1 Introduction

This section describes the constitution of the overall responses. The section starts with an analysis of all responses in general and then considers a more detailed description for each of the four questionnaire types. This section therefore sets the scene for all subsequent analyses and reference will be made back to this overall demographic analysis during the rest of the report.

3.2 Responses in general

A total of 3,275 questionnaires were either entered into the electronic data collection system or sent, electronically or in paper form, to the collection centre in York, England. Figure 3.1 shows the distribution of these returns across the four participating groups, Table 3.1 in Appendix 1 shows the actual numbers.

Figure 3.1. Distribution of responses by questionnaire types.



The ratio of returns planned in the design of the survey was approximately 71% student, 7% employer, 4% academic and 18% graduate. In numbers terms this represented a challenging target for all participants of the project. Three countries collected their actual target numbers of every type of questionnaire others collected a mixed balance across the types. The target balance was selected to allow comparisons to be drawn between the stakeholder groups in each country as well as across the whole of Europe.

In terms of overall numbers of questionnaires, an ambitious target for every participating country was set. An overall number of 7,280 questionnaires would have been received had every partner met target. The actual number of returns is 45% of this target. Given the size of some of the participating countries the overall number of completed returns is considered to be good and has not compromised the ability to analyse the results and extract conclusions from them. What will not be possible is to look at the supply demand balance in detail for all participating countries. For those where the full quota, or close to the full quota has been achieved the supply demand picture is analysed in detail. These analyses can be found in Section 8 of this report.

The distribution of responses by country is more complex as the country of the respondent varied depending on the questionnaire type. However, a meaningful comparison can be made between students, academics and graduates. In all these types the respondent was asked what country they are currently studying in, working in (as an academic) or studied in as a graduate. Employers were asked which country they are based in. But since they are likely to recruit employees from more than that country the question of country is less meaningful in a comparison. Table 3.2 shows the distribution of responses by country of academic institution.

Table 3.2. Distribution of returns by country

Country	Academic	Graduate	Student	Total
Austria			2	2
Belgium	1		2	3
Bulgaria	10	50	197	257
Cyprus	4		3	7
Czech Republic	1		3	4
Demark			2	2
Estonia	6	2	84	92
Finland			1	1
France	14	1	342	357
Germany	1	1	5	7
Greece	15	29	241	285
Hungary			221	221
Iceland			5	5
Ireland	10		113	123
Italy	8	9	95	112
Latvia	4	3	65	72
Lithuania	8		1	9
Poland	11	50	238	299
Portugal	7	1	76	84
Romania	1		12	13
Slovak Republic	20	62	389	471
Slovenia		1	7	8
Spain	34	41	140	215
Sweden			1	1
Turkey	14	33	192	239
United Kingdom	10	1	206	217
Other	3			3

The three countries that met the design target for returns in all four categories are Bulgaria, Poland and the Slovak Republic.

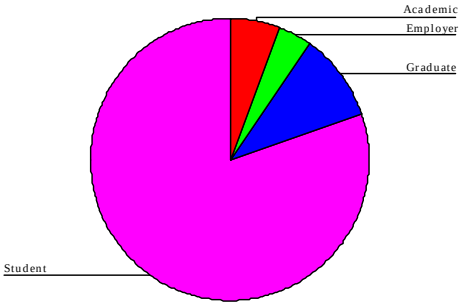
As has already been noted the EIE discipline set is generally under represented by females across Europe. Figure 3.3 shows the overall gender balance across the four types of respondents, the numbers for these figures can be found in Table 3.3 in Appendix 1. This survey also shows a gender imbalance in all types. Gender is an analysis theme throughout this report so the breakdown shown in Table 3.3 is important from a contextual point of view.

Important note:

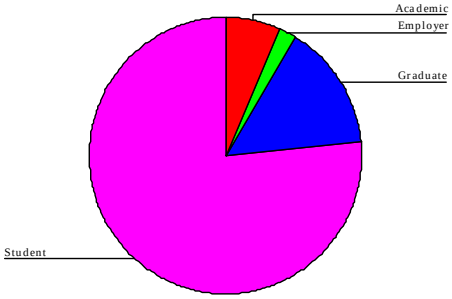
It is worth noting, as is common in almost all questionnaire based surveys, that not all questionnaires will be completed correctly, completely and meaningfully. This survey is no exception and a number of returns were only partly completed and some were obviously ‘spoiled’ in some way. All but the most obviously and totally unusable questionnaires have been entered into the overall dataset, however the ‘spoiled’ or uncompleted sections of questionnaires are excluded from analyses where their inclusion would distort the analysis and conclusions to be drawn. The clear manifestation of this approach will be where the number (usually n) is shown in any analysis or results table. The number in any table will not necessarily add up to be the same as in another table showing an analysis of a related point. Such differences are not errors, rather the consequence of the way the questionnaires have been completed.

Figure 3.3 Distribution of responses by gender.

Male



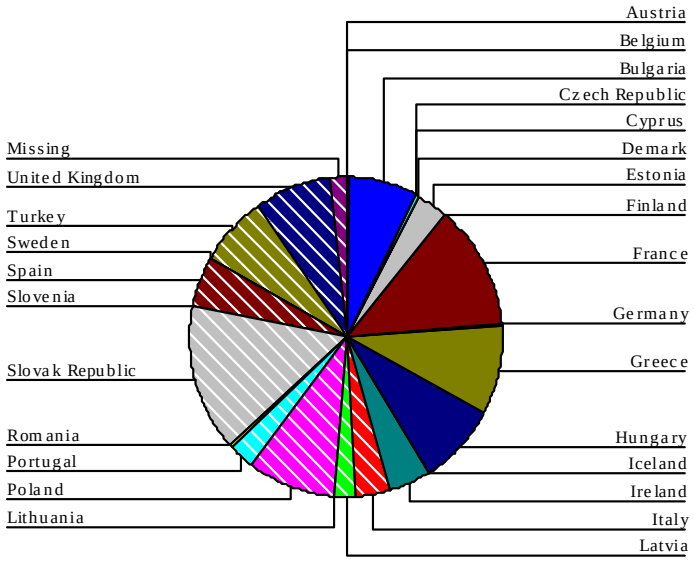
Female



3.3 Student responses

As is noted in Table 3.1 the total number of questionnaires received from students is 2,691. Of these 2,641 stated their gender. Of these 14.5% are female and 85.5% male. The distribution of student returns by country is shown in Figure 3.4. The numerical values for Figure 3.4 including by gender are shown in Table 3.4 in Appendix 1. The percentage of females is shown where the total number of responses is greater than 12 (there is a natural breakpoint in the data between 12 and 64). For those countries with a response of 12 or less the percentage is considered to suffer too much from small sample inaccuracies to be meaningful.

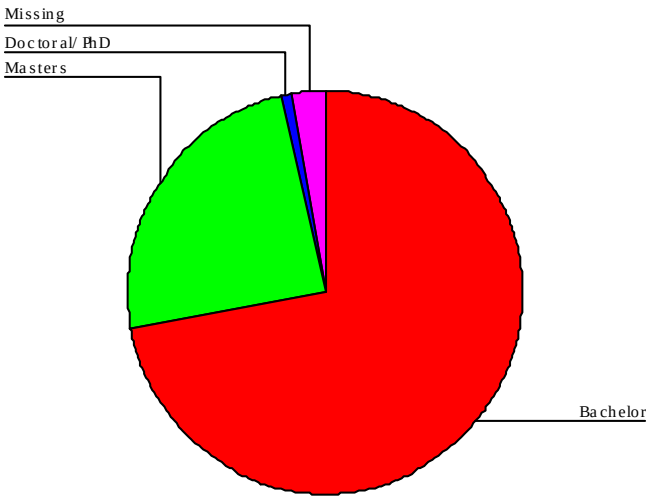
Figure 3.4. Distribution of student responses by country



Students were asked to state their level of study. Figure 3.5 shows the distribution across the three main study levels (Bachelor, Masters and Doctoral). Table 3.5 in Appendix 1 shows the actual numbers. A

degree of interpretation has been used in dealing with some responses, especially those from France where a number of students declared they are studying for a Diploma qualification. This is a first cycle qualification and has hence been interpreted in this study as 'Bachelor' level of study.

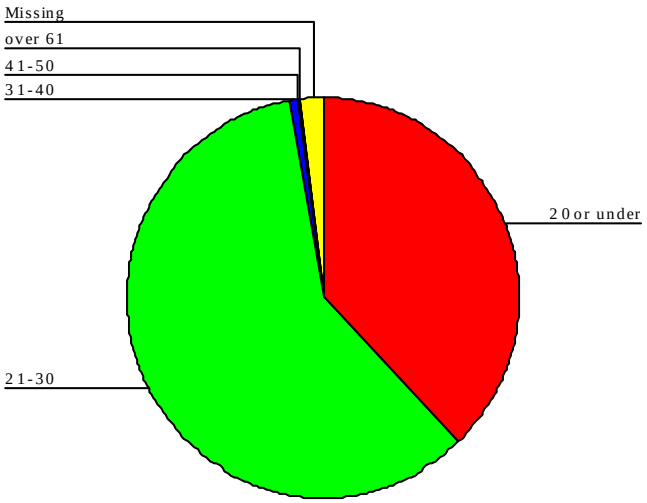
Figure 3.5 Distribution of student responses by level of study



As can be seen from Table 3.5 the size of the Doctoral level sample is quite small (n=23). As a consequence care is taken in this report in drawing conclusions about students studying at this level.

Figure 3.6 and Table 3.6 (in Appendix 1) show the distribution of student responses by age band. As is expected the majority of responses (99.0%) are from individuals in the conventional age range for students.

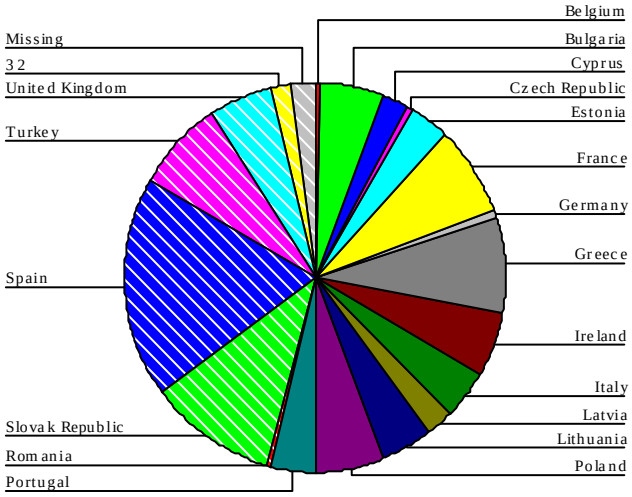
Figure 3.6 Distribution of student responses by age band



3.4 Academic responses

Figure 3.7 and Table 3.7 (Appendix 1) shows how the academic responses are distributed around Europe.

Figure 3.7 Distribution of academic responses by country

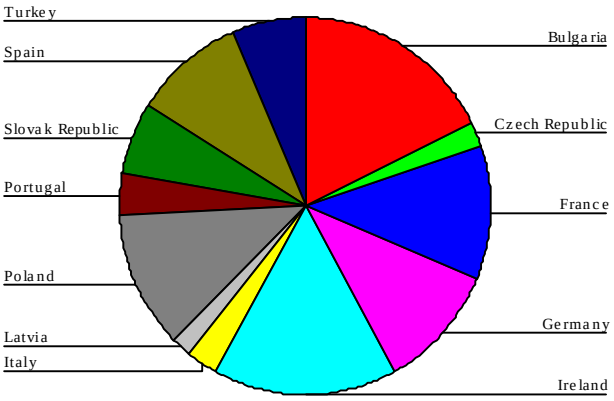


The largest number of academic responses is from Spain with the Slovak Republic, Greece, France and Turkey also providing sufficient number for a comparative analysis.

3.5 Employer responses

Figure 3.8 and Table 3.8 (Appendix 1) shows how the academic responses are distributed around Europe.

Figure 3.8 Distribution of employer responses by country



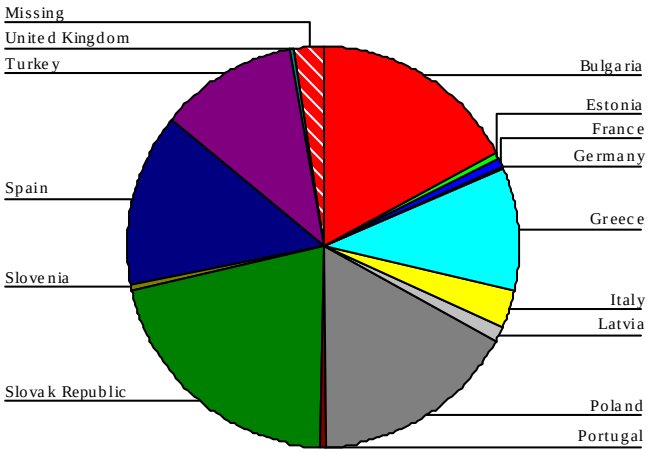
The largest number of employer responses was obtained from Bulgaria with sufficient numbers also from Ireland, France, Poland, Germany and Spain.

Employers and graduates were asked to identify the country they are currently working in. Table 3 summarizes this distribution.

3.6 Graduate responses

Figure 3.9 and Table 3.9 (Appendix 1) shows how the graduate responses are distributed around Europe.

Figure 3. Distribution of graduate responses by country.



The largest number of responses is from the Slovak Republic with Bulgaria, Spain, Turkey, Greece and Poland providing a sufficient number for a comparative analysis.

It is anticipated that there may be some overlap between graduates and employers so Table 3.10 compares the returns between employers and graduates by country. A more detailed look at the similarities between these groups is considered in section 8.

Table 3.10 Geographic dispersion of Employer and Graduate responses

Country	Employer	Graduate	Total
Belgium		2	2
Bulgaria	20	50	70
Czech Republic	2	2	4
Demark		1	1
Estonia		2	2
Finland		1	1
France	12	3	15
Germany	12	2	14
Greece		31	31
Ireland	18		18
Italy	3	10	13
Latvia	2	3	5
Norway		1	1
Poland	13	29	42
Portugal		1	1
Slovak Republic	7	63	70
Slovenia		1	1
Spain	11	38	49
Turkey	7	33	40

4. The student view

4.1 Introduction

This section looks in detail at the student responses to the survey. Reference should be made to the constitution of the students who have responded in Section 3 of this report.

Of particular interest is how students feel their study programme is preparing them for employment; how they rate their employment potential; and how they rate the competences that are being developed in them by their study programme. Three types of competences are considered, generic, language and specific. These aspects are considered in turn in this section.

4.2 Student perception of employment potential

In response to the question "Do you feel that the degree programme is preparing you adequately for employment?" the overall mean response is 2.53 on a 1 to 5 scale where 1 indicates "very much"; 2 indicates "much"; 3 indicates "some"; 4 indicates "little"; and 5 indicates "very little". The mean response by gender and level of study is summarized in Figure 4.1 (Tabulated results are shown in Table 4.1 in Appendix 1).

Figure 4.1 Mean student response by gender and level of study

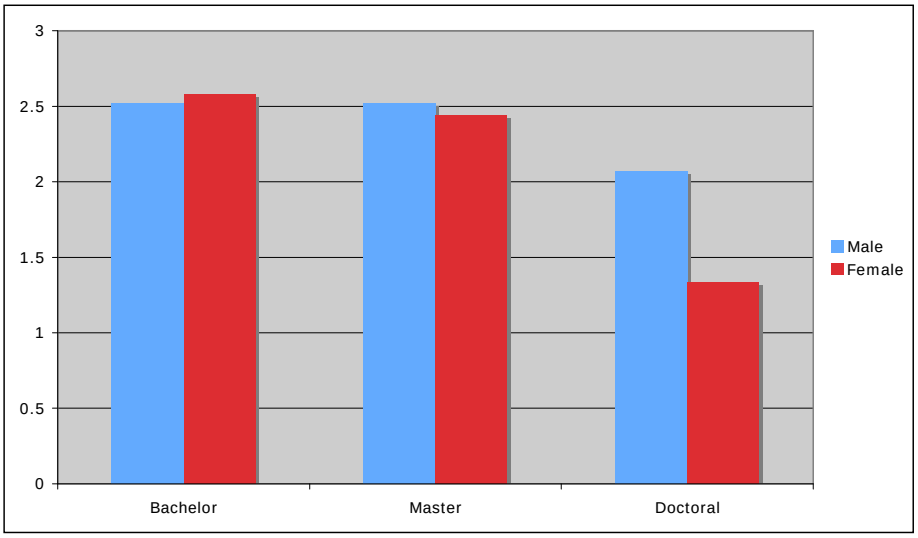


Figure 4.1 shows that there is very little difference (and no statistically significant differences) in the overall view of all students across Europe of the preparation their academic programme is giving them. The overall mean for Bachelor and Master level students is midway between "some" and "much", a positive response but not an overwhelming vote of confidence in the level of preparation they are receiving for employment.

Figure 4.2 (and Table 4.2 in Appendix 1) explores the variation in student perception of preparation across the different countries. Note in the table that only those countries where there is a number of responses above 12 are included to avoid the potential of small numbers suggesting meaning.

Figure 4.2 Mean student response to "Do you feel that the degree programme is preparing you adequately for employment?" by country.

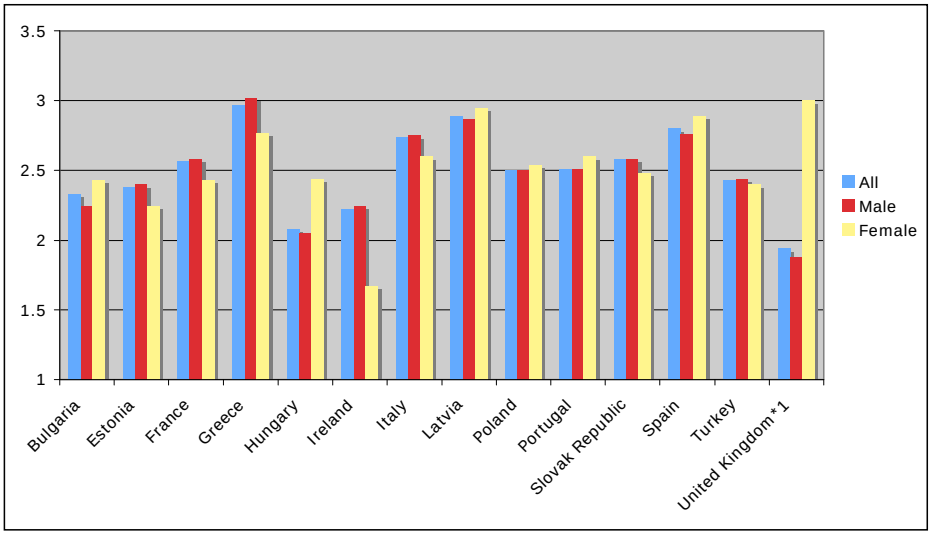


Table 4.2 reveals some country differences but little variation between the genders in each country. The country differences may be a result of differences in the study programme or as a result of the general employment potential in that country. To try to answer this question, students were asked to answer the question "How would you rate the employment potential of your degree?"

Table 4.3 shows the mean response by gender across the same country set. The table shows that the mean response is again midway between "some" and "much" and that there are variations between countries.

A comparison of the mean of "Do you feel that the degree programme is preparing you adequately for employment?" and "How would you rate the employment potential of your degree?" says something about the alignment of the student perception of their study programme and employment.

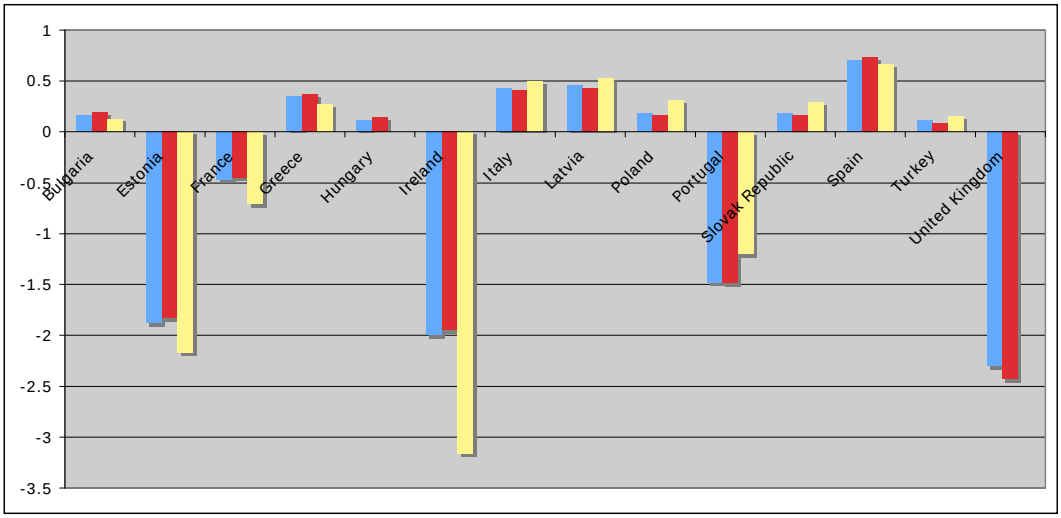
Table 4.3 Mean student response to "How would you rate the employment potential of your degree?" by country.

Country	All	Male	Female
Bulgaria	2.16	2.06	2.3
Estonia	4.26	4.23	4.42
France	3.04	3.03	3.14
Greece	2.62	2.65	2.5
Hungary	1.96	1.91	2.44
Ireland	4.22	4.2	4.83
Italy	2.31	2.34	2.1
Latvia	2.43	2.44	2.42
Poland	2.32	2.33	2.23
Portugal	3.99	4	3.8
Slovak Republic	2.4	2.41	2.19
Spain	2.09	2.03	2.23
Turkey	2.32	2.35	2.25
United Kingdom[*1]	4.24	4.31	3

*Notes: [*1] Computer Science students only*

Taking France as an example, students rate their preparation for employment at 2.57 and their employment potential at 3.04. The employment potential is just worse than "some" and a numerical difference in this direction indicates the students perceive that they are more prepared for employment than their potential for employment. Contrast this with Greece, for example, where the mean rating of preparation for employment is 2.97 and the employment potential is 2.62. In the case of Greece the potential for employment is rated higher (numerically lower) than the level of preparation. The magnitude and direction (sign) of this difference is therefore an indicator of the perceived gap between preparation for employment and employment potential. The differences are summarized in Figure 4.4. (Tabulated data for this table can be found in Table 4.4 in Appendix 1.)

Figure 4.4 Difference between "Do you feel that the degree programme is preparing you adequately for employment?" and "How would you rate the employment potential of your degree?" by country.



As a reminder, in Figure 4.4 in countries with lines above the zero line students feel they are more prepared for employment than their potential for employment. Where the lines are below zero students feel they are less prepared than their potential for employment.

4.3 Student perception of generic competence development

For a set of 32 generic competences students were asked to rate how important they feel each is to the work they expect to do and on the level to which the competence is being developed by their study programme. Both questions are answered to a 4 point Likert scale where 1 indicates "none"; 2 indicates "weak"; 3 indicates "considerable"; and 4 indicates "strong". An analysis of the responses to each question in isolation indicates the perceived value of each generic competence and in its level of development. An analysis of the difference between the rating of these questions for each competence indicates the gap between value and level of development and hence how well the student perceives the match of their degree programme to their need[1].

4.3.1 Student perception of importance of the generic competences

Table 4.5 shows, in descending order of magnitude, the mean importance of the top and bottom 5 generic competences for all students. A full table is included as Table 4.5 in Appendix 1. Recall that 4 is the highest score (indicating "strong"). Note that the lowest ranked competence still has a mean of 2.52, midway between "weak" and "considerable" – hence no generic competence is really considered very low in importance.

[1] The assumption here is that rating of importance is based on personal need.

Table 4.5 All student rating of importance of the generic competences.

Rank	Generic competence	Mean
1	Problem solving	3.48
2	Elementary computing skills	3.44
3	Capacity for applying knowledge in practice	3.41
4	Teamworking	3.41
5	Will to succeed	3.36
…		
28	International Relations and Collaborations	2.92
29	Patents and Intellectual Property Rights	2.79
30	Appreciation of ethical issues	2.72
31	Appreciation of diversity and multiculturality	2.71
32	Understanding of cultures and customs of other countries	2.52

Table 4.5 shows that "Problem Solving" is rated as the most important competence by students and that "Understanding of cultures and customs of other countries" is rated least important. A look at the order of the means by gender does not show any material differences (all differences are small and not statistically significant). Further, a look at the order between Bachelor and Master level students also shows few differences.

Overall the position of some of the generic competences merits comment:

1. The competences usually associated with enterprise/entrepreneurship ("Initiative and entrepreneurial spirit" and "Patents and Intellectual Property Rights") tend to lie to the bottom of the list with only "Capacity for generating new ideas (creativity)" being ranked important (7^{th} in the list).
2. All competences associated with internationalism ("Ability to work in an international context", "International Relations and Collaborations", "Appreciation of diversity and multiculturality", and "Understanding of cultures and customs of other countries") all score low. "Knowledge of a second language" lies midway in the list. Overall this placement should be a concern for mobility generally.
3. "Research skills" is rated low in the list, a concern for those institutions with aspirations towards developing their students into future research careers. That said there may be many reasons for this particular placement, current year of study possibly being one.

In addition to rating the importance of each generic competence on a 1..4 scale, students were asked to identify the most importance competences for them and place them in order of importance. Since any specific generic competence can appear in any box a weighted scoring system has been used to produce an overall ranking of the competences. Any number that appeared in the first box, that is they were the respondents most important competence is weighted 5, the second choice 4, etc. The weighted sum of the score and the frequency of occurrence of a competence in that box gives an overall value for each competence. The highest indicates the most chosen competence. Table 4.6 shows the top and bottom 5, in descending order of popularity for students studying at the Bachelor level. The table also shows the value obtained from the weighting calculation, there is no real meaning in the magnitude of this value but the difference between the values indicates the separation between choices. A full list is shown in Table 4.6 in Appendix 1.

Table 4.6 Weighted ranking of importance of generic competences by Bachelor level students

Rank	Generic Competence	Score
1	Problem solving	1823
2	Teamworking	1624
3	Capacity for applying knowledge in practice	1584
4	Knowledge of a second language	1231
5	Capacity for analysis and synthesis	1176
…		
28	International Relations and Collaborations	167
29	Appreciation of ethical issues	148
30	Understanding of cultures and customs of other countries	129
31	Appreciation of diversity and multiculturality	115
32	Patents and Intellectual Property Rights	60

The results of this analysis should align with the ranking order that results from the analysis of means (i.e. the Bachelor level equivalent of Table 4.5). A comparison of these tables shows some many similarities but a few marked differences between the two ordered lists:

1. 3 of the top 5 appear in both lists, all of the bottom 5 are the same in both lists
2. “Information management skills” appears 13 places lower in the chosen important competences compared to the 1..4 mean.
3. “Elementary Computing Skills” appears 10 places lower
4. “Research Skills” and “Leadership” both appear 11 places higher in the chosen important competences table
5. “Knowledge of a second language” appears 12 places higher
6. “Capacity for analysis and synthesis” appears 8 places higher

All other generic competences are within +/-6 places in both lists.

This result, on the one hand confirms general consistency between the two ways of gaining an understanding of the relative importance students place on the generic competences. It does, however, beg the question, which is the more “accurate”. A review of the completed questionnaires shows that in a number of cases students have omitted to answer the 1..4 questions but have made a choice for their top 5. In some other cases, especially where the student has completed the 1..4 response questions in an obvious pattern (and hence “spoiled” that part of the questionnaire) there is no recognizable pattern to the free choice of top 5. This may suggest they have given some thought to their top 5 choices. On this basis it can be argued, although not conclusively proved, that the selection of the top 5 produces the more accurate view of student perception. There is, however, value in the 1..4 ratings as they permit more detailed comparisons to be made.

4.3.2 Student perception of level of development of the generic competences

Table 4.7 shows, in descending order of magnitude, the mean level of development of the top and bottom 5 generic competences for all students. Here again 4 is the highest score (indicating “strong”). A full table is shown in Table 4.7 in Appendix 1.

Note that the lowest ranked competence has a mean of 2.03, or “weak”. Students clearly feel that the level of development of, in particular “Understanding of cultures and customs of other countries” is weak on average across Europe. Whether it should he better developed is a point explored later in the comparative analysis sections.

Table 4.7 shows that “Elementary computing skills” is rated as the best developed competence by students. This is perhaps, for some, a disappointment as the development of elementary computing skills is not a learning objective and is probably a competence assumed in the student body.

Table 4.7 All student rating of level of development of the generic competences.

Rank	Generic competence	Mean
1	Elementary computing skills	3.2
2	Problem solving	2.97
3	Capacity to learn	2.96
4	Teamworking	2.94
5	Basic general technical knowledge of the profession of your work area	2.91
…		
28	Leadership	2.3
29	International Relations and Collaborations	2.3
30	Appreciation of ethical issues	2.29
31	Patents and Intellectual Property Rights	2.27
32	Understanding of cultures and customs of other countries	2.03

Second in the list is "Problem Solving", a competence that probably does appear in the learning objectives of academic programmes in the EIE discipline and is top of the list of rated importance by students – so there is an immediate and clear indicator of good alignment between student rating of importance and their view on how well it is developed in them. A look at the order of the means by gender does not show any material differences (all differences are small and not statistically significant). Further, a look at the order between Bachelor and Master level students also shows few differences.

4.3.3 Student perception of 'gap' in the generic competences

In the previous sections "Problem Solving" is rated most important and second most well developed of all the generic competences, suggesting a small 'gap' in how students need is being met. This notion of 'gap' can be quantified by looking at the numerical difference between the rated importance and level of development for each generic competence. The algorithm used is:

Difference = Rated importance – Level of development

Given that both rated importance and level of development are in the range 1..4, the valid range of the difference is -3..+3 and a positive difference indicates that the rated importance is greater than the level of development – or students need is greater than what they are receiving.

Table 4.8 shows the 'gap' for all students and for males and females separately for the top and bottom 5 generic competences. A full table is shown in Table 4.8 in Appendix 1.

Table 4.8 Comparison of mean difference between rated importance and level of development of the generic competences for all students by gender.

Rank	Generic competence	All	Male	Female
1	Knowledge of a second language	0.79	0.78	0.81
2	Ability to work in an international context	0.76	0.77	0.72
3	Capacity for generating new ideas (creativity)	0.74	0.74	0.77
4	Leadership	0.67	0.69	0.61
5	Capacity for applying knowledge in practice	0.63	0.62	0.69
	…			
28	Ability to work autonomously	0.38	0.38	0.41
29	Research skills	0.37	0.36	0.42
30	Basic general technical knowledge of the profession of your work area	0.34	0.33	0.43
31	Grounding in basic knowledge of the profession of your work area	0.28	0.26	0.39
32	Elementary computing skills	0.25	0.25	0.26

Across all students "Knowledge of a second language" is top of the 'gap' list. This indicates that academic institutions (at least those involved in this survey) are, on average, not delivering this competence to the level the students rate it as important. The next few at the top of the list are "Ability to work in an international context", "Capacity for generating new ideas (creativity)" (3rd), "Leadership" (4th), "International Relations and Collaborations" (6th), and "Initiative and entrepreneurial spirit" (8th). These generally group to entrepreneurialism and internationalism and the results suggest academic institutions could be doing more in these two areas.

Table 4.8 also shows the mean 'gap' for male and female students. Overall the differences between the genders is small and not statistically significant.

Table 4.9 shows the mean for the top and bottom 5 generic competences for Bachelor and Master level students. A full version of Table 4.9 is shown in Appendix 1.

Table 4.9 Comparison of mean difference between rated importance and level of development of the generic competences for all students by level of study.

Generic competence	Bachelor	Master
Knowledge of a second language	0.76	0.88
Capacity for generating new ideas (creativity)	0.76	0.72
Ability to work in an international context	0.75	0.83
Leadership	0.69	0.66
Ability to work in an interdisciplinary team	0.64	0.49
…		
Capacity for analysis and synthesis	0.41	0.38
Research skills	0.4	0.28
Basic general technical knowledge of the profession of your work area	0.37	0.29
Grounding in basic knowledge of the profession of your work area	0.28	0.27
Elementary computing skills	0.28	0.2

In Table 4.9 the competences shown in bold italics are where there is a statistically significant difference between the Bachelor and Master level responses. The direction of the difference can be understood by looking at the value of the means.

There are some significant differences between the study levels. "Knowledge of a second language" is top at both levels. At Master level students consider "International Relations and Collaborations" in the top 5 along with "Capacity for applying knowledge in practice". This suggests that at Masters level capacity of applying knowledge in practice, for example, with a larger gap, is either being taken for granted at this level or is not being developed as much as the pure theoretical aspects of the discipline. Students clearly perceive the need for knowing how to apply this knowledge in practice.

Table 4.10 shows the top and bottom 5 'gaps' for the countries with the top 5 largest student responses. A full version of this table can be found in Table 4.10 in Appendix 1.

Table 4.10 has been sorted by the French student's responses – they being the first column alphabetically. However, this rather hides the wide differences between the countries in their student rating of the gap in provision. The largest 'gap' for French students is "International Relations and Collaborations" but for Hungarian and Slovak Republic students the largest gap is "Knowledge of a second language", which for French students comes 15th in their ranking. For Greek and Polish students it is "Ability to work in an International Context" that is ranked top, although being ranked top means their perception of the importance of the competence to how well it is being developed in their institution is widest and hence merits attention by academic programme designers.

Table 4.10 Comparison of mean difference between rated importance and level of development for all students by country.

Generic competence	France	Greece	Hungary	Poland	Slovak Republic
International Relations and Collaborations	1.1	0.63	0.39	0.81	0.58
Capacity to adapt to new situations	1.06	0.74	0.76	0.54	0.42
Ability to work in an interdisciplinary team	1.01	0.69	0.83	0.34	0.46
Ability to work in an international context	1	0.96	0.72	0.91	0.69
Capacity for generating new ideas (creativity)	0.95	0.88	0.91	0.72	0.71
…					
Teamworking	0.47	0.38	0.88	0.35	0.6
Grounding in basic knowledge of the profession of your work area	0.44	0.47	-0.21	0.26	0.19
Research skills	0.44	0.69	0.32	0.19	0.25
Capacity to learn	0.43	0.75	0.48	0.32	0.31
Elementary computing skills	0.39	0.36	0.15	0.16	0.31

4.4 Student perception of language competence development

All students were asked to indicate their perception of the level of importance and level of development of written and spoken ability in each of the European languages except for their native language. Each answer (4 per language) is to a 4-point scale the same as for the generic and specific competences. Table 4.11 in appendix 1 shows the overall mean of all four questions for each language in descending order of rated importance.

Most students also responded for their native language and this is not taken into account in Table 4.11. It should, however be noted that the number of native English and German speaking students (the top two languages) are small in number and the effect of their inclusion will not have a significant effect on these results.

Clearly English is viewed as the most important written and spoken language with a mean of over 3.3 on a 1 to 4 scale. German is second with a mean of just below 2 where 2 indicates “weak”. France and Slovak Republic students, in the main, rated their own language as important and this needs to be taken into account as, to a lesser extent, did the respondents from Spain. Overall all languages except English score lower that “weak” in terms of rated importance.

On level of development, English is again highest with a mean of 2.72 for written and 2.67 for spoken, with 2 representing “weak” and 3 “considerable”. The fact that there is a ‘gap’ between the mean rated importance and level of development again shows that students needs are not being currently met by their academic programmes. There are some statistically significant differences between the mean Bachelor and Master level of study responses but only the difference in English are worthy of note. Table 4.11 shows the difference by level of study.

Table 4.11 Mean student importance and level of development response for the English language by level of study

Ability in English language	Bachelor level	Master level
Importance of written	3.35*	3.47*
Importance of spoken	3.36*	3.49*
Level of development of written	2.74	2.70
Level of development of spoken	2.69	2.66

* Denotes statistically significant difference

From Table 4.11 it can be seen that the ‘gap’ is wider at master level than at the bachelor level and the level of importance is rated as higher, in contrast the level of development at master level is considered lower.

Table 4.12 shows the mean responses by gender. Here again there are statistically significant differences with males considering English to be more important than females and to be more well developed in their study programmes, although the effect size is small in all cases.

Table 4.12 Mean student importance and level of development response for the English language by gender

Ability in English language	Male	Female
Importance of written	3.41*	3.16*
Importance of spoken	3.43*	3.15*
Level of development of written	2.75*	2.61*
Level of development of spoken	2.70*	2.54*

* Denotes statistically significant difference

4.5 Student perception of specific competence development

For a set of 28 specific competences students were asked to rate how important they feel each is to the work they expect to do and on the level to which the competence is being developed by their study programme. Both questions are answered to a 4 point Likert scale where 1 indicates "none"; 2 indicates "weak"; 3 indicates "considerable"; and 4 indicates "strong". An analysis of the responses to each question in isolation indicates the perceived value of each specific competence and in its level of development. An analysis of the difference between the rating of these questions for each competence indicates the gap between value and level of development and hence how well the student perceives the match of their degree programme to their need.

4.5.1 Student perception of importance of the specific competences

Table 4.13 shows, the top and bottom 5 mean importance of all the specific competences for all students (a full table is included at Table 4.13 in Appendix 1). Recall that 4 is the highest score (indicating "strong"). Note that the lowest ranked competence has a mean of 2.78, which is close to "considerable" – hence no specific competence is really considered low in importance.

Table 4.13 Student perception of the importance of the specific competences

Rank	Specific competence	Mean
1	Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.29
2	Ability to work in a group on a major project	3.29
3	Ability to demonstrate practical engineering skills	3.24
4	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.2
5	Ability to apply a systems approach to engineering problems	3.17
…		
24	Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.83
25	Ability to demonstrate knowledge and understanding of the commercial and economic context	2.82
26	Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.81
27	Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.8
28	Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.78

Table 4.13 shows that the specific competences rated least in importance are those that look beyond the technicalities of the discipline. The top 5 contrast well with the bottom 5. Those at the top are core classical engineering competences, those at the bottom are broader commercial competences which some students struggle to see the relevance of in engineering degrees.

In addition to rating the importance of each specific competence on a 1..4 scale, students were asked to identify the most important competences in order of importance. Table 4.14 shows, using the same weighting system as was used for the generic competences, the top and bottom 5 rated important competences. A full version of the table is shown in Appendix 1.

Table 4.14 Rank order of rated specific competences for all students and for Bachelor and Master level students.

Rank	Specific competence	All	Bachelor	Master
1	Ability to work in a group on a major project	1	2	1
2	Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	2	1	4
3	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3	3	2
4	Ability to demonstrate practical engineering skills	4	5	3
5	Ability to apply a systems approach to engineering problems	5	4	6
…				
24	Ability to demonstrate understanding of appropriate codes of practice and industry standards	24	20	27
25	Ability to demonstrate awareness of quality issues	25	25	23
26	Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	26	26	22
27	Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	27	27	18
28	Ability to demonstrate awareness of the nature of intellectual property and contractual issues	28	28	28

There is very little difference in the top and bottom 5 specific competences as shown in Table 4.14. Also a comparison of the top specific competences shown in Table 4.14 and Table 4.13 shows there is good agreement between the rank order and the order revealed by means.

4.5.2 Student perception of level of development of the specific competences

Table 4.15 shows, in descending order of magnitude, the top and bottom 5 mean level of development of the specific competences for all students. The lowest ranked competence has a mean of 2.25, between "weak" and "considerable", so students feel all the listed specific competences are being developed above the level of weak. A full version of this table can be found in Appendix 1.

Table 4.15 shows that "Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline" is rated the best developed competence very closely followed by "Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems". This second competence is in the top 2 for rated importance (see Table). This is an encouraging outcome and suggests a review of the difference between rated importance and level of development, or the 'gap' will again be useful. A 'gap' analysis is shown in the next section.

Table 4.15 Student perception of the level of development of the specific competences

Rank	Specific competence	Mean
1	Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2.9
2	Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	2.89
3	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	2.86
4	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	2.72
5	Ability to apply a systems approach to engineering problems	2.71
…		
24	Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.33
25	Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.33
26	Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.32
27	Ability to demonstrate knowledge and understanding of the commercial and economic context	2.29
28	Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.25

Table 4.16 shows the top and bottom 5 gender difference in means for the specific competences for students at all levels of study.

Table 4.16 Student perception of the level of development of the specific competences by gender

Rank	Specific competence	Male	Female
1	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	2.85	2.91
2	Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2.91	2.9
3	Ability to apply and integrate knowledge and understanding of other engineering disciplines	2.59	2.58
4	Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.44	2.44
5	***Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement***	***2.31***	***2.5***
…			
24	Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.33	2.37
25	Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.46	2.47
26	Ability to demonstrate awareness of quality issues	2.49	2.54
27	Ability to work with technical uncertainty	2.52	2.48
28	***Ability to work in a group on a major project***	***2.67***	***2.83***

The three specific competences for which there are statistically significant differences are shown in bold.

4.5.3 Student perception of 'gap' in the specific competences

As in the case of the generic competences, a top and bottom 5 'gap' analysis is shown in Table 4.17 for all students. A full version of the table can be found in Appendix 1

Table 4.17 Comparison of mean difference between rated importance and level of development of the specific competences for all students by gender.

Rank	Specific competence	All	Male	Female
1	Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.67	0.68	0.59
2	Ability to identify and manage cost drivers in designs and projects	0.64	0.65	0.6
3	Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.61	0.61	0.59
4	Ability to work in a group on a major project	0.6	0.61	0.51
5	Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.56	0.55	0.62
…				
24	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.37	0.37	0.4
25	Ability to demonstrate understanding of the use of technical literature and other information sources	0.37	0.37	0.36
26	Ability to demonstrate awareness of quality issues	0.36	0.39	0.25
27	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.34	0.34	0.37
28	Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	0.09	0.08	0.15

There are no statistically differences in the magnitude of the 'gap' between the genders. However, the order of the gap is difference.

Across all students "Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process" is top of the 'gap' list. This indicates that academic institutions (at least those involved in this survey) are, on average, not delivering this competence to the level the students rate it as important. The other specific competences at the top of the list also merit thought by academic institutions with competences ranked 1, 2 and 5 being related to the broader issues of design and the design process. Competences ranked 3rd and 4th are more generic in nature, 3rd being creativity and innovativeness in synthesis and solutions and in formulating solutions – this can be taken to imply that EIE education currently seeks more to applying standard approaches to problems. However, again caution should be taken in too narrowly interpreting this as the impact of study year could be an important consideration. Fourth in the list is "Ability to work in a group on a major project", this could reflect an absence of opportunity to work in a group.

Given the differences in student response in difference countries, caution is needed in applying these generalized findings locally. Table 4.18 shows the mean of the top 5 specific competences across the countries for which there is a meaningful number of usable returns for this analysis.

Table 4.18 shows that for all the considered countries the largest gap in all five competences exists in Estonia followed by Spain and Italy.

Table 4.18 Mean of the top 5 specific competence 'gap' by country

In what country is your Institution	Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	Ability to identify and manage cost drivers in designs and projects	Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	Ability to work in a group on a major project	Overall mean
Estonia	1.07	1.07	1.04	1	0.86	1.008
Spain	0.78	0.95	0.73	0.79	0.78	0.806
Italy	0.65	0.9	0.93	0.81	0.55	0.768
France	0.74	0.66	0.69	0.75	0.69	0.706
Greece	0.78	0.72	0.62	0.73	0.66	0.702
Poland	0.7	0.71	0.73	0.59	0.51	0.648
Latvia	0.66	0.66	0.7	0.47	0.7	0.638
Slovak Republic	0.75	0.6	0.53	0.45	0.67	0.6
Hungary	0.63	0.46	0.6	0.52	0.76	0.594
Portugal	0.58	0.5	0.41	0.49	0.52	0.5
Ireland	0.54	0.61	0.46	0.31	0.33	0.45
Turkey	0.43	0.49	0.39	0.34	0.44	0.418
Bulgaria	0.34	0.42	0.45	0.34	0.2	0.35

Table 4.19 shows the gap by level of study.

Table 4.19 Comparison of mean difference between rated importance and level of development of the specific competences for all students by level of study.

Specific competence	All	Bachelor	Master
Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.67	0.66	0.7
Ability to identify and manage cost drivers in designs and projects	0.64	0.62	0.7
Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.61	0.6	0.63
Ability to work in a group on a major project	0.6	0.6	0.59
Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.56	0.56	0.56
…			
Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.37	0.38	0.33
Ability to demonstrate understanding of the use of technical literature and other information sources	0.37	0.38	0.35
Ability to demonstrate awareness of quality issues	0.36	0.39	0.34
Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.34	0.36	0.3
Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	**0.09**	**0.12**	**0.03**

The gaps for which the difference is statistically significant are shown in bold. The differences are not of any significant size.

5. The academic view

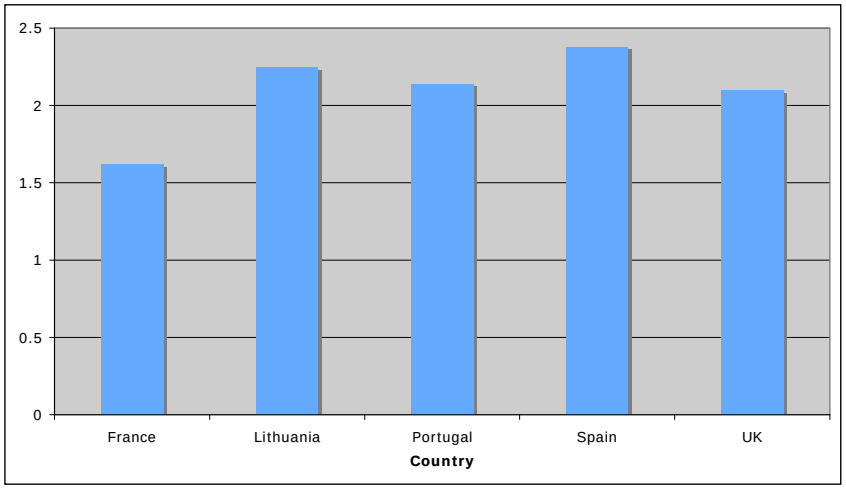
5.1 Introduction

This section looks in detail at the academic responses to the survey. Reference should be made to the constitution of the academics who have responded in Section 3 of this report. Of particular interest is how academics feel their institution's study programme is preparing their students for employment; how they rate the employment potential of their students; and how they rate the competences that are being developed in their students by their study programme. Three types of competences are considered, generic, language and specific. These aspects are considered in turn in this section.

5.2 Academic perception of employment potential

In response to the question "Do you feel that the degree programme is preparing your students adequately for employment?" the overall mean response is 2.19 at the Bachelor level and 1.88 at the Master level. Note both are on a 1 to 5 scale where 1 indicates "very much"; 2 indicates "much"; 3 indicates "some"; 4 indicates "little"; and 5 indicates "very little". Overall academics feel that Master level education is preparing students more for employment than Bachelor level. The difference is not, however statistically significant. A breakdown of mean response by country is shown in Figure 5.1 and Table 5.1 (Appendix 1) for the countries where there are sufficient returns to make the result meaningful.

Figure 5.1 Mean academic perception of employment potential of their students



5.3 Academic perception of generic competence development

For a set of 32 generic competences academics were asked to rate how important they feel each is to the work they expect their students to do and on the level to which the competence is being developed by their study programme. Both questions are answered to a 4 point Likert scale where 1 indicates "none"; 2 indicates "weak"; 3 indicates "considerable"; and 4 indicates "strong". An analysis of the responses to each question in isolation indicates the perceived value of each generic competence and in its level of development. An analysis of the difference between the rating of these questions for each competence indicates the gap between value and level of development and hence how well the academic perceives the match of their degree programme to their student's need[2].

[2] The assumption here is that rating of importance is based on personal need.

5.3.1 Academic perception of importance of the generic competences

Table 5.2 shows the mean of the importance of the top and bottom 5 generic competences for all academics. A full version of Table 5.2 is provided in Appendix 1.

Table 5.2 Mean of the importance of the generic competences for all academics

Rank	Generic competence	Mean
1	Elementary computing skills	3.6
2	Capacity for applying knowledge in practice	3.58
3	Problem solving	3.58
4	Capacity for analysis and synthesis	3.54
5	Basic general technical knowledge of the profession of your work area	3.53
…		
28	Leadership	2.82
29	International Relations and Collaborations	2.79
30	Appreciation of diversity and multiculturality	2.66
31	Patents and Intellectual Property Rights	2.65
32	Understanding of cultures and customs of other countries	2.5

Table 5.2 shows that academics rate all but 8 of the generic competences to be of "considerable" importance or stronger. The most important is "Elementary computing skills" with "Capacity for applying knowledge in practice" and "Problem solving" very close behind in joint second place. It is interesting to note that these top three are also the top three for all students – this comparative view is explored in more detail in section 8 of this report. The least important competence is "Understanding of cultures and customs of other countries" again in agreement with the views of all students.

An analysis by gender for academics is not considered to be meaningful however, an analysis by level of study for which the response is being completed is. Figure 5.3 shows the distribution of academic responses by level. There are sufficient numbers of responses at the Bachelor and Master levels to allow a meaningful comparison.

Figure 5.3 Distribution of academic responses by study level

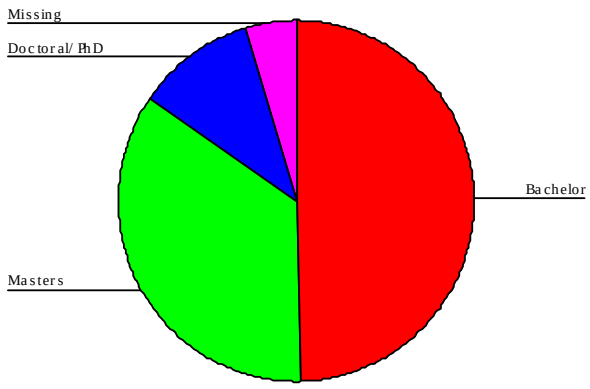


Table 5.4 shows the mean top and bottom 5 generic competences by level of study. A full version of this table is shown in Appendix 1. There is a statistically significant difference in 5 of the competences, shown in bold in Table 5.4. In all 5 cases the mean at the Bachelor level is higher than that at the Master level indicating academics feel the competences are more important for study at the Bachelor level. The

difference in "Leadership" and "Appreciation of diversity and multiculturality" are both of medium effect size[3], the other three are small.

Table 5.4 Mean importance of the generic competence comparing the Bachelor and Master levels

Rank	Generic competence	Bachelor	Master
1	Elementary computing skills	3.7	3.51
2	Capacity for applying knowledge in practice	3.6	3.6
3	Problem solving	3.58	3.57
4	Basic general technical knowledge of the profession of your work area	3.55	3.49
5	Capacity for analysis and synthesis	3.54	3.52
…			
28	Research skills	2.85	2.85
29	***Appreciation of diversity and multiculturality***	***2.84***	***2.45***
30	International Relations and Collaborations	2.83	2.69
31	Patents and Intellectual Property Rights	2.67	2.62
32	***Understanding of cultures and customs of other countries***	***2.62***	***2.31***

5.3.2 Academic perception of level of development of the generic competences

Table 5.5 shows the mean level of development of the top and bottom 5 generic competences as perceived by all academics and by study level.

Table 5.5 Mean level of development of the generic competences for all academics and by level of study

Rank	Generic competence	All	Bachelor	Master
1	Elementary computing skills	3.39	3.48	3.37
2	***Basic general technical knowledge of the profession of your work area***	***3.21***	***3.32***	***3.05***
3	Capacity for analysis and synthesis	3.14	3.18	3.11
4	Grounding in basic knowledge of the profession of your work area	3.08	3.16	3.03
5	Capacity for applying knowledge in practice	3.06	3.11	3.06
…				
28	Appreciation of ethical issues	2.36	2.45	2.32
29	International Relations and Collaborations	2.33	2.41	2.23
30	***Leadership***	***2.31***	***2.48***	***2.13***
31	Understanding of cultures and customs of other countries	2.15	2.24	2.08
32	Patents and Intellectual Property Rights	2.09	2.12	2.08

In Table 5.5 the level of development of three of the generic competences are rated as statistically significantly different between the Bachelor and Master study levels (shown in bold). In all three cases the level of development is considered higher at the Bachelor than the Master level and the difference in "Leadership" is a medium size effect. To gain a better picture of the significance of these results a 'gap' analysis between the rated importance and level of development is now considered.

[3] As given by Cohen's d

5.3.3 Academic perception of 'gap' in the generic competences

Table 5.6 shows the top and bottom 5 mean 'gaps' for all academics and by study level. None of the differences between study levels are statistically significant. A full version of this table can be found in Appendix 1.

Table 5.6 Mean gap between rated importance and level of development of the generic competences for all academics and by level of study

Rank	Generic competence	All	Bachelor	Master
1	Knowledge of a second language	0.74	0.71	0.68
2	Ability to work in an interdisciplinary team	0.7	0.66	0.72
3	Initiative and entrepreneurial spirit	0.67	0.69	0.65
4	Planning and time management	0.65	0.67	0.62
5	Capacity to adapt to new situations	0.65	0.68	0.58
…				
28	Understanding of cultures and customs of other countries	0.35	0.38	0.23
29	Basic general technical knowledge of the profession of your work area	0.32	0.22	0.45
30	Appreciation of diversity and multiculturality	0.3	0.38	0.14
31	Grounding in basic knowledge of the profession of your work area	0.24	0.19	0.32
32	Elementary computing skills	0.21	0.22	0.14

Academics consider knowledge of a second language to be the competence with the highest mismatch between rated importance and level of development. Interestingly this is the same as for students. Next is ability to work in an interdisciplinary team. This competence is ranked 17th of all the generic competences (Table 5.2) with a mean of 3.22 – above "considerable". Academics clearly recognize the value of this competence in their students but perhaps do not have the opportunity to develop it within their own institutions. Initiative and entrepreneurial spirit are next highest in 'gap' followed by "planning and time management" and "capacity to adapt to new situations". Planning and time management is not ranked very high in the overall importance ranking (19th out of 32) yet is an important general student study skill.

The competences at the bottom of the list indicate the smallest gap between importance and level of development indicating that their development is closely matched to need. Interestingly all gaps are positive indicating rated importance is higher than level of development (on the same rating scale) in all cases.

There is some variation in the ranking of the 'gap' across Europe. For example, in Bulgaria the top 5 ranked gaps are:

1 "Planning and time management"

2 "Ability to work in an interdisciplinary team"

3 "Knowledge of a second language"

4 "Initiative and entrepreneurial spirit"

5 "Oral and written communications in your native language"

For French academics Capacity for generating new ideas (creativity)" is top with "Knowledge of a second language" second. Irish academics rank "Capacity to adapt to new situations" top.

A full table of all the 'gaps' for all the generic competences across countries with sufficient responses to make the analysis meaningful is given in Table 5.7 in Appendix 1.

5.4 Academic perception of language competence development

All academics were asked to indicate their perception of the level of importance and level of development of written and spoken ability in each of the European languages except for their native language. Each

answer (4 per language) is to a 4 point scale the same as for the generic and specific competences. As is the case for students, academics only rated the English language as being important and being developed above a mean of 1.5, hence only English is considered in detail in this section. Table 5.8 shows the overall mean of all four questions for each language in descending order of rated importance.

Table 5.8 Mean rated importance and level of development of English for all academics and by level of study.

Ability in English language	All academics	Bachelor level	Master level
Importance of written	3.63	3.63	3.71
Importance of spoken	3.58	3.59	3.63
Level of development of written	2.82	2.77	2.86
Level of development of spoken	2.80	2.75	2.81

Table 5.6 shows that academics consider that competence in the English language is more important at Master level than at Bachelor level. None of the differences between levels are statistically significant.

5.5 Academic perception of specific competence development

For a set of 28 specific competences academics were asked to rate how important they feel each is for the work their students at the study level they are answering the questionnaire for expect to do and on the level to which the competence is being developed by their programme. Both questions are answered to a 4 point Likert scale where 1 indicates "none"; 2 indicates "weak"; 3 indicates "considerable"; and 4 indicates "strong". An analysis of the responses to each question in isolation indicates the perceived value of each specific competence and in its level of development. An analysis of the difference between the rating of these questions for each competence indicates the gap between value and level of development and hence how well the academic perceives the match of their degree programme to need.

5.5.1 Academic perception of importance of the specific competences

Table 5.9 shows, in descending order of magnitude, the top and bottom 5 mean importance of all the specific competences for all academics and by study level. Recall that 4 is the highest score (indicating "strong"). Note that the lowest ranked competence for all academics has a mean of 2.78, which is close to "considerable" – hence no specific competence is really considered low in importance. A full version of this table can be found in Appendix 1.

Table 5.9 Academic perception of the importance of the specific competences

Rank	Specific competence	All	Bachelor	Master
1	Ability to demonstrate practical engineering skills	3.57	3.63	3.55
2	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.45	3.48	3.43
3	Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.45	3.43	3.49
4	Ability to apply a systems approach to engineering problems	3.43	3.42	3.52
5	Ability to work in a group on a major project	3.4	3.48	3.4
…				
24	Ability to demonstrate knowledge and understanding of the commercial and economic context	2.94	3.07	2.85
25	Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.93	2.97	2.91

26	Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.82	2.78	2.83
27	Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.79	2.9	2.68
28	Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.78	2.84	2.74

The top 5 specific competences are all the direct application competences of the engineering discipline in practice whereas the bottom 5 are the broader commercial aspects of engineering. This can be taken as a positive indicator of the primary desire of EIE academics to produce technically able engineers. This is potentially, however, at the expense of their commercial awareness upon graduation. That said, the lowest ranked competence still has an importance rating close to "considerable".

5.5.2 Academic perception of level of development of the specific competences

Table 5.10 shows, in descending order of magnitude, the top and bottom 5 mean level of development of all the specific competences for all academics and by level of study for which they answered the questionnaire. The lowest ranked competence has a mean of 2.17, between "weak" and "considerable", so academics in general feel all the listed specific competences are being developed above the level of weak. A full version of this table can be found in Appendix 1.

Table 5.10 Academic perception of the level of development of the specific competences for all and by level of study

Rank	Specific competences	All	Bachelor	Master
1	Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.14	3.22	3.08
2	Ability to demonstrate practical engineering skills	3.09	3.19	3
3	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.08	3.16	3.02
4	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	2.95	3.04	2.88
5	Ability to demonstrate understanding of the use of technical literature and other information sources	2.92	2.97	2.91
…				
24	Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.35	2.47	2.31
25	Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.34	2.31	2.35
26	Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.34	2.44	2.33
27	Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.18	2.31	2.11
28	Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.17	2.2	2.2

To a large extent the ranking of the level of development of the specific competences mirrors the rated importance with the technical competences at the top and the commercial and broader competences at the bottom. The mean score of the lowest ranked at 2.17 is close to "weak", this reflects an overall academic view that the development of these more commercial dimensions in their students is only weakly needed. A comparison with the employer's view on these competences is given in section 8.

5.5.3 Academic perception of 'gap' in the specific competences

As in the case of the generic competences, a top and bottom 5 'gap' analysis is shown in Table 5.11 for all academics. A full version of the table can be found in Appendix 1.

Table 5.11 Comparison of mean difference between rated importance and level of development of the specific competences for all academics and by level of study.

Rank	Specific competence	All	Bachelor	Master
1	Ability to identify and manage cost drivers in designs and projects	0.68	0.64	0.68
2	Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	0.64	0.64	0.6
3	Ability to demonstrate understanding of appropriate codes of practice and industry standards	0.62	0.67	0.61
4	Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	0.61	0.59	0.57
5	Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.61	0.63	0.57
…				
24	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.38	0.34	0.42
25	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.36	0.32	0.42
26	Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	0.32	0.22	0.48
27	Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.32	0.21	0.42
28	Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	0.32	0.26	0.35

The specific competence with the largest gap between rated importance and level of development is "Ability to identify and manage cost drivers in designs and projects". Whilst this is ranked 15th in importance it is ranked 19th in level of development. The fact that this emerges as the competence with the largest gap is probably more a result of the similarity in rankings than this being a particularly weak aspect of curricula.

Perhaps of most importance are those at the bottom of the table which indicate a good match between importance and level of development. In the bottom 5 there are, encouragingly, some of the foundation competences of the discipline.

As was the case in the generic competences, there is variation in the way academics in different countries rate the gap between importance and level of development of the specific competences. The top ranked gap is:

- Bulgaria: “Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues.”
- France: “Ability to demonstrate a appreciation of the wider multidisciplinary engineering context and its underlying principles.”
- Greece and Spain: “Ability to identify and manage cost drivers in designs and projects.”
- Ireland: “Ability to apply and integrate knowledge and understanding of other engineering disciplines.”
- Poland: “Ability to apply a systems approach to engineering problems.”
- Slovak Republic “Ability to demonstrate awareness of quality issues.”
- UK: “Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development.”

Table 5.12 (Appendix 1) shows a full list of all the specific competence gaps for these countries.

6. The employer view

6.1 Introduction

This section looks in detail at the employer responses to the survey. Reference should be made to the constitution of the employers who have responded in Section 3 of this report. Of particular interest is how employers feel that Higher Education Institutions have given their employees adequate preparation for working in this work area in their company as well as the usual set of questions relating to the importance and level of development of the generic, specific and language competences. These aspects are all considered in turn in this section.

6.2 Employer perception of preparation for employment

In response to the question "Do you consider that Higher Education Institutions have given your employees adequate preparation for working in this work area in your company?" The overall mean response is 2.28 for all employers who responded to this question. They were also asked to identify which educational level of employee they are answering this question for. 50 of the employers completed the questionnaire for Bachelor level employees and 50 responded for Master level employees. The mean response at the Bachelor level is 2.26 while that at the Master level is 2.22. (The overall mean of 2.28, being higher than the means of both the Bachelor and Master level responses is explained by high means in the few respondents at the Doctoral level and those at other or no response academic levels.) Note that the mean is on a 1 to 5 scale in which 1 indicates "very much"; 2 indicates "much"; 3 indicates "some"; 4 indicates "little" and 5 indicates "very little". The results show that employers consider Bachelor level education is preparation students better for employment than Bachelor level education but the difference is small and not statistically significant. For both levels the employers feel preparation is closer to "some" than "much".

6.3 Employer perception of generic competence development

For a set of 32 generic competences employers were asked to rate how important they feel each is to the work they expect their graduate recruits to do. The question is answered to a 4 point Likert scale where 1 indicates "none"; 2 indicates "weak"; 3 indicates "considerable"; and 4 indicates "strong". An analysis of the responses indicates the perceived value of each generic competence and in its level of development. An analysis of the difference between the rating of these questions for each competence indicates the gap between value and level of development and hence how well the student perceives the match of their degree programme to their need[4].

6.3.1 Employer perception of importance of the generic competences

Table 6.1 shows the top and bottom 5 mean of the importance of the generic competences for all employers and for the two main levels of study for which they completed the questionnaire. A full version of the table can be found in Appendix 1.

Employers are in agreement with students that "Problem solving" is the most important generic competence. Second is "Concern for quality", a very understandable competence for employers. Third equal are "Capacity to learn" and "Teamworking". It should be noted that the mean for all of the top 5 overall are very similar. When the academic levels are considered separately "Elementary computing skills" is top for the Bachelor level and "Teamworking" for Master level students, both with "Problem solving" second.

Bottom for all and for both academic levels is "Understanding of cultures and customs of other countries". Others at the lower end of the list are the competences associated with Internationalisation, Entrepreneurship, Leadership and Research. Perhaps this reflects the view that EIE programmes should first and foremost focus on engineering and engineering practice although the majority of employer respondents were from large established firms into which new graduates can be placed in positions appropriate to an engineering degree.

[4] The assumption here is that rating of importance is based on personal need.

Table 6.1 Mean of importance of the generic competences for all employers and by level of study

Rank	Generic competences	All	Bachelor	Masters
1	Problem solving	3.62	3.54	3.73
2	Concern for quality	3.61	3.51	3.73
3	Capacity to learn	3.6	3.54	3.63
4	***Teamworking***	***3.6***	***3.46***	***3.76***
5	Capacity for applying knowledge in practice	3.59	3.46	3.71
…				
28	***Appreciation of diversity and multiculturality***	***2.78***	***2.51***	***3.05***
29	Leadership	2.72	2.59	2.8
30	***International Relations and Collaborations***	***2.68***	***2.46***	***2.88***
31	Patents and Intellectual Property Rights	2.61	2.49	2.73
32	Understanding of cultures and customs of other countries	2.51	2.44	2.56

Table 6.2 shows the top and bottom 5 rank order of generic competences as revealed by the free choice of first to fifth preferred by each employer. The table also shows the rank position by academic level. A full version of the table can be found in Appendix 1.

Table 6.2 Weighted ranking of importance of generic competences by employers for all and by study level

Rank	Generic competence	All	Bachelor	Masters
1	Capacity for applying knowledge in practice	142	52	87
2	Capacity for analysis and synthesis	110	50	60
3	Capacity to learn	79	44	30
4	Teamworking	77	20	54
5	Basic general technical knowledge of the profession of your work area	71	36	34
…				
28	Will to succeed	7	5	2
29	Leadership	6	6	0
30	Appreciation of ethical issues	6	5	1
31	Patents and Intellectual Property Rights	4	0	4
32	Understanding of cultures and customs of other countries	0	0	0

The alignment of the free ranked importance and the mean of the rated importance (Tables 6.1 and 6.2 respectively) differs more than in the students and academics cases. 3 of the top 5 from Table 6.2 are also in the top 5 of Table 6.1 however “Problem solving” and “Concern for quality” are not in the top 5. “Research skills” is rated 4th for Bachelor level students and 13th for Master students – which is an unexpected result. Also “Oral and written communications in your native language” falls from 7th to 21st place in rank order. There are no obvious reasons for these differences.

6.3.2 Employer perception of level of development of the generic competences

Table 6.3 shows, in descending order of magnitude, the top and bottom 5 mean level of development of all the generic competences for all employers and by academic level. A full version of the table can be found in Appendix 1.

Table 6.3 Employer view of mean level of development for the generic competences by academic level

Rank	Generic competence	All	Bachelor	Master
1	Elementary computing skills	3.46	3.61	3.34
2	Capacity to learn	3.19	3.17	3.2
3	Oral and written communication in your native language	3.13	3.1	3.15
4	Will to succeed	3	3.02	2.98
5	Basic general technical knowledge of the profession of your work area	2.99	3.1	2.95
…				
28	Planning and time management	2.48	2.59	2.39
29	Understanding of cultures and customs of other countries	2.36	2.29	2.39
30	Leadership	2.26	2.29	2.17
31	International Relations and Collaborations	2.26	2.12	2.34
32	Patents and Intellectual Property Rights	2.18	2.05	2.27

Slightly in contrast to the rated important generic competences, those rated most developed are the personal skills of "Elementary computing skills", "Capacity to learn", "Oral and written communications in your native language" and "Will to succeed". The more technical competences follow lower down in the rankings. Of those that lie at the bottom of the list are the competences employers feel are least well developed. Note that the lowest, "Patents and Intellectual Property Rights" scores a mean of 2.18, just above "weak". For patents and IPR this is perhaps acceptable as the large employer respondents probably have professional staff or have secured the services of professionals to provide this service to their organisation. However, 5th form the bottom of the list is "Planning and time management", a competence academics might feel they try hard to develop in their students and, as can be seen form Table 5.5, it does appear considerably higher in the academics view of its development. A clear difference in view.

Again a gap analysis will show the real areas where employers feel the academic programme is not developing competences to the level they feel is important.

6.3.3 Employer perception of 'gap in the generic competences

As in the case of the generic competences, a top and bottom 5 'gap' analysis is shown in Table 6.4 for all employers. A full version of the table can be found in Appendix 1

Table 6.4 Comparison of mean difference between rated importance and level of development of the generic competences for all employers and by academic level.

Rank	Generic competence	All	Bachelor	Master
1	Concern for quality	0.79	0.66	0.98
2	Planning and time management	0.75	0.56	0.93
3	Capacity for applying knowledge in practice	0.74	0.54	0.9
4	Problem solving	0.72	0.63	0.78
5	Teamworking	0.72	0.76	0.71
…				
28	Research skills	0.33	0.41	0.24
29	Grounding in basic knowledge of the profession of your work area	0.26	0.05	0.44
30	Appreciation of diversity and multiculturality	0.26	0.1	0.46
31	Understanding of cultures and customs of other countries	0.14	0.15	0.17
32	Elementary computing skills	0.09	0.1	0.1

Top of the list overall is "Concern for quality". This is dominated by a clear difference at the Masters level. At the Bachelor level the greatest gap is in "Teamworking". "Planning and time management" is second overall, again principally because of the Master level responses, it is ranked 6th for Bachelor students. It is

clear from the top few in the list where employers feel the academic programmes their graduate recruits have taken are falling short of their "need" in the generic competences.

Encouragingly at the bottom of the list there appears to be no issue with Elementary computing skills although the academics who feel that this is not a core component of their degree programme will gain little comfort from this outcome. The other competences at the bottom of the Table 6.4 are generic competences employers feel are being developed in line with their rating of its importance.

There is variation in the way employers in different countries rate the gap between importance and level of development of the generic competences. The top ranked gap is:

- Bulgaria: "Capacity for applying knowledge in practice", "Decision making", "Leadership" (equal top)
- France: "Capacity to adapt to new situations", "Teamworking" (equal top)
- Germany: "Planning and time management"
- Ireland: "Teamworking"
- Poland: "Planning and time management"
- Slovak Republic "Ability to work autonomously"

Table 6.4(a) (Appendix 1) shows a full list of all the generic competence gaps for these countries.

Table 6.4(a) in Appendix 1 shows the gap in the generic competences by country where sufficient responses to be meaningful are available.

6.4 Employer perception of language competence development

All employers were asked to indicate their perception of the level of importance and level of development of written and spoken ability in each of the European languages except for their native language. Each answer (4 per language) is to a 4 point scale the same as for the generic and specific competences. As is the case for students, employers rated the English language as being the most important and the most developed. German, Spanish, Bulgarian and French were the next most popular set of languages, but all have means indicating importance and development less than "weak".

Table 6.5 Shows the overall mean of all four questions for the English language for all employers and by academic level

Ability in English language	All employers	Bachelor level	Master level
Importance of written	3.46	3.37	3.55
Importance of spoken	3.54	3.50	3.61
Level of development of written	2.91	2.97	2.87
Level of development of spoken	2.95	2.89	3.00

Table 6.5 shows that written and spoken English ability is rated as more important for Master than Bachelor level students. The level of development of written and spoken English is less than rated importance at both levels.

6.5 Employer perception of specific competence development

For a set of 28 specific competences employers were asked to rate how important they feel each is for the work for which they are completing the questionnaire and the level to which the competence is being developed by the study programme of their graduate employees. Both questions are answered to a 4 point Likert scale where 1 indicates "none"; 2 indicates "weak"; 3 indicates "considerable"; and 4 indicates "strong". An analysis of the responses to each question in isolation indicates the perceived value of each specific competence and in its level of development. An analysis of the difference between the rating of these questions for each competence indicates the gap between value and level of development and hence how well the employer perceives the match of their degree programme to need.

6.5.1 Employer perception of importance of the specific competences

Table 6.6 shows, in descending order of magnitude, the top and bottom 5 mean importance of all the specific competences for all employers and by academic level. Recall that 4 is the highest score (indicating "strong"). Note that the lowest ranked competence for all employers has a mean of 2.78, which is close to "considerable" – hence no specific competence is really considered low in importance. A full version of this table can be found in Appendix 1.

Table 6.6 Employer perception of importance of the specific competences by academic level

Rank	Specific competence	All	Bachelor	Master
1	Ability to demonstrate awareness of quality issues	3.34	3.44	3.23
2	Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	3.28	3.33	3.2
3	Ability to demonstrate understanding of the use of technical literature and other information sources	3.27	3.47	3.03
4	Ability to work in a group on a major project	3.25	3.36	3.13
5	Ability to apply a systems approach to engineering problems	3.24	3.31	3.13
…				
24	Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.91	3	2.8
25	Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.9	2.97	2.8
26	Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.87	2.81	2.93
27	Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.79	2.72	2.87
28	Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.76	2.83	2.67

The top 5 important specific competences are very general in nature. Top is "Ability to demonstrate awareness of quality issues" which aligns well with employers rating of "Concern for quality" in the generic competences. The more general applied technical competences of "Developing practical engineering skills", "demonstrate knowledge and understanding of scientific facts, concepts, etc.", etc. are all in the upper middle of the ranked order. The bottom of the list is again populated with the more commercial and entrepreneurial competences. The overall order of the ranking does not vary very much between the Bachelor and Master levels.

6.5.2 Employer perception of level of development of the specific competences

Table 6.7 shows, in descending order of magnitude, the top and bottom 5 mean level of development for the specific competences for all employees and by academic level for which they answered the questionnaire. The lowest ranked competence has a mean of 2.22, between "weak" and "considerable". A full version of the table is shown in Appendix 1.

The top 5 competences in Table 6.7 are the fundamental engineering competences and it is encouraging to see employers recognise that these are the most well developed of all the specific competences. The top 5 also do not vary very significantly between academic levels.

The bottom 5 are again the more commercial and entrepreneurial competences so there is a feel of alignment between importance and level of development. The actual alignment is considered in detail in the next subsection.

Table 6.7 Employer perception of level of development of the specific competences by academic level

Rank	Specific competences	All	Bachelor	Master
1	Ability to demonstrate understanding of the use of technical literature and other information sources	3.01	3.19	2.8
2	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	2.9	2.83	2.97
3	Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	2.87	2.97	2.73
4	Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2.82	2.92	2.7
5	Ability to demonstrate practical engineering skills	2.78	2.94	2.57
…				
24	Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.33	2.44	2.17
25	Ability to manage the design process and evaluate outcomes	2.31	2.47	2.1
26	Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.3	2.36	2.2
27	Ability to identify and manage cost drivers in designs and projects	2.22	2.36	2.03
28	Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.22	2.33	2.07

6.5.3 Employer perception of level of 'gap in the specific competences

As in the case of the generic competences the top and bottom 5 'gap' analysis is shown in Table 6.8 for all employers and by academic level. A full version of this table can be found in Appendix 1.

Table 6.8 Comparison of mean difference between rated importance and level of development of the specific competences for all employers and by level of study.

Rank	Specific competence	All	Bachelor	Master
1	Ability to identify and manage cost drivers in designs and projects	0.91	0.83	1.03
2	Ability to demonstrate awareness of quality issues	0.7	0.78	0.63
3	Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.69	0.67	0.73
4	Ability to demonstrate understanding of appropriate codes of practice and industry standards	0.69	0.72	0.67
5	Ability to manage the design process and evaluate outcomes	0.64	0.69	0.6
…				
24	Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.34	0.39	0.3
25	Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.34	0.36	0.33
26	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.33	0.47	0.17
27	Ability to demonstrate understanding of the use of technical literature and other information sources	0.25	0.28	0.23
28	Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	0.18	0.25	0.1

The top gap in the specific competences for employees is the same as that for academics, namely "Ability to identify and manage cost drivers in designs and projects". This is top for both Bachelor and Master level students. "Awareness of quality issues" is second which aligns well with the gap in the generic competences where quality also featured strongly. At the bottom of the table are the fundamentals of the EIE discipline which appear to be being developed appropriately for their rated importance for employers.

As was the case in the generic competences, there is variation in the way employers in different countries rate the gap between importance and level of development of the specific competences. The top ranked gap is:

- Bulgaria and Ireland: "Ability to identify and manage cost drivers in designs and projects"
- France: "Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement."
- Germany: "Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline"
- Slovak Republic "Ability to apply a systems approach to engineering problems."

Table 6.9 (Appendix 1) shows a full list of all the specific competence gaps for these countries.

7. The graduate view

7.1 Introduction

This section looks in detail at the graduate responses to the survey. Reference should be made to the constitution of the graduates who have responded in Section 3 of this report. Of particular interest is how graduates feel that Higher Education Institutions has prepared them for employment as well as the usual set of questions relating to the importance and level of development of the generic, specific and language competences. These aspects are all considered in turn in this section.

7.2 Graduate perception of preparation for employment

In response to the question "Do you consider that University has given you adequate preparation for working in this work area in your company?" the overall mean response is 2.19 for all graduates who responded. Table 7.1 shows how this varies between gender and study level.

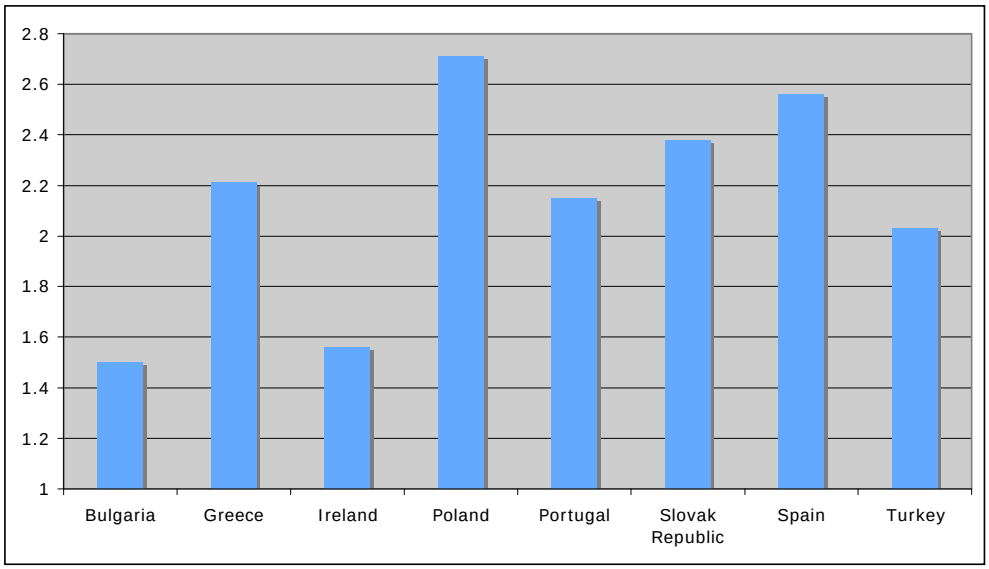
Table 7.1 Mean preparedness for work for graduates by gender and study level

	Bachelor	Master
Male	2.31	2.16
Female	2.59	1.94

The difference between Master and Bachelor levels for females is statistically significant and interestingly females consider they are less prepared for work at Bachelor level but more at Master level than their male peers. Note that the scale is 1 to 5 with 1 being "very much" and 5 "very little".

A breakdown of the mean response by country is shown in Table 7.2 for the countries where there are sufficient responses to make the result meaningful. Table 7.2 in Appendix 1 shows the corresponding numerical data. The figure shows considerable variation across the countries with Bulgarian and Irish graduates feeling very prepared whereas Polish and Spanish less so.

Figure 7.2 Mean perception of preparedness for employment of graduates by country



7.3 Graduate perception of generic competence development

For a set of 32 generic competences graduates were asked to rate how important they feel each is to the work they expect to do and on the level to which the competence was developed in the academic programme they undertook. Both questions are answered to a 4 point Likert scale where 1 indicates "none";

2 indicates “weak”; 3 indicates “considerable”; and 4 indicates “strong”. An analysis of the responses to each question in isolation indicates the perceived value of each generic competence and in its level of development. An analysis of the difference between the rating of these questions for each competence indicates the gap between value and level of development and hence how well the graduate perceives the match of their degree programme to their need as defined by their current work[5].

7.3.1 Graduate perception of importance of the generic competences

Table 7.3 shows the mean of the importance of the generic competences for all employers and for the two main levels of study for which they completed the questionnaire. A full version of this table is shown in Appendix 1.

Table 7.3 Mean of importance of the generic competences for all graduates and by level of study

Rank	Generic competence	All	Bachelor	Master
1	Problem solving	3.59	3.71	3.53
2	Capacity for applying knowledge in practice	3.53	3.6	3.49
3	Elementary computing skills	3.51	3.59	3.47
4	Capacity for analysis and synthesis	3.49	3.58	3.45
5	Capacity to learn	3.48	3.59	3.42
…				
28	International Relations and Collaborations	2.9	2.88	2.92
29	Patents and Intellectual Property Rights	2.8	2.73	2.83
30	Appreciation of ethical issues	2.68	2.64	2.72
31	Appreciation of diversity and multiculturality	2.67	2.62	2.71
32	Understanding of cultures and customs of other countries	2.43	2.39	2.47

In line with both students and employers, graduates rate “Problem solving” as the most important generic competence at both Bachelor and Masters levels. The general order of the competences is also very similar between levels as was for the case of students and employers with multinational and entrepreneurial competences well down in the importance ranking. Table 7.3(a) shows that there is also general agreement between the rankings of graduates form the analysed countries.

Finally there is generally good agreement between the weighted ranking of the generic competences and the means for the 1..4 response questions. Table 7.4 in Appendix 1 shows the weighted ranking able for all graduates and by academic level.

7.3.2 Graduate perception of level of development of the generic competences

Table 7.5 shows, in descending order of magnitude, the mean level of development of all the generic competences for all employers and by academic level. A full version of this table is shown in Appendix 1.

There is generally good agreement between the level of development and the ranked importance. Graduates on average across all countries therefore feel their academic programmes have met their needs. Table 7.5(a) (Appendix 1) shows the table for all countries and also shows thag this view is held in each of the analysed countries.

[5] The assumption here is that rating of importance is based on personal need.

Table 7.5 Graduate view of mean level of development for the generic competences by academic level

Rank	Generic competence	All	Bachelor	Master
1	Elementary computing skills	3.32	3.34	3.32
2	Capacity to learn	3.19	3.21	3.18
3	Problem solving	3.15	3.07	3.15
4	Capacity for analysis and synthesis	3.12	3.07	3.13
5	Teamworking	3.08	2.95	3.12
…				
28	Appreciation of diversity and multiculturality	2.35	2.27	2.4
29	Leadership	2.33	2.24	2.38
30	Patents and Intellectual Property Rights	2.31	2.18	2.39
31	International Relations and Collaborations	2.3	2.16	2.38
32	Understanding of cultures and customs of other countries	2.07	1.92	2.14

7.3.3 Graduate perception of 'gap in the generic competences

As in the case of the generic competences, a top and bottom 5 'gap' analysis is shown in Table 7.6 (Appendix 1). The top 5 generic competences for the Bachelor level are:

1 Ability to work in an international context
2 Planning and time management
3 Ability to communicate with non-experts (in the field)
4 Leadership
5 Capacity for generating new ideas (creativity)

For the Masters level they are:

1 Ability to work in an international context
2 Knowledge of a second language
3 Planning and time management
4 Capacity for generating new ideas (creativity)
5 International Relations and Collaborations

There is variation in the way graduates in different countries rate the gap between importance and level of development of the generic competences. The top ranked gap is:

- Bulgaria: "Planning and time management"
- Greece: "Capacity to adapt to new situations"
- Ireland: "Ability to work in an interdisciplinary team"
- Poland: "Capacity for applying knowledge in practice"
- Slovak Republic and Spain: "Knowledge of a second language"
- Turkey: "Ability to work in an international context"

Table 7.6(a) (Appendix 1) shows a full list of all the generic competence gaps for these countries.

7.4 Graduate perception of language competence development

All employers were asked to indicate their perception of the level of importance and level of development of written and spoken ability in each of the European languages except for their native language. Each answer (4 per language) is to a 4 point scale the same as for the generic and specific competences. As is the case for students, employers rated the English language as being the most important and the most developed all other languages have means indicating importance and development less than "weak". Table

7.7 shows that English is rated more important than the level of development at both study levels and very little difference between the levels.

Table 7.7 Shows the overall mean of all four questions for the English language for all graduates and by academic level

Ability in English language	All graduate	Bachelor level	Master level
Importance of written	3.48	3.53	3.45
Importance of spoken	3.43	3.42	3.41
Level of development of written	2.81	2.81	2.81
Level of development of spoken	2.72	2.64	2.76

7.5 Graduate perception of specific competence development

For a set of 28 specific competences graduates were asked to rate how important they feel each is for the work for which they are completing the questionnaire and the level to which the competence is being developed by their study programme. Both questions are answered to a 4 point Likert scale where 1 indicates "none"; 2 indicates "weak"; 3 indicates "considerable"; and 4 indicates "strong". An analysis of the responses to each question in isolation indicates the perceived value of each specific competence and in its level of development. An analysis of the difference between the rating of these questions for each competence indicates the gap between value and level of development and hence how well the employer perceives the match of their degree programme to need.

7.5.1 Graduate perception of importance of the specific competences

Table 7.8 shows, in descending order of magnitude, the mean importance of all the specific competences for all employers and by academic level. Recall that 4 is the highest score (indicating "strong"). Note that the lowest ranked competence for all employers has a mean of 2.61, which is close to "considerable" – hence no specific competence is really considered low in importance.

Table 7.8 Graduate perception of importance of the specific competences by academic level

Rank	Specific competence	All	Bachelor	Master
1	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.34	3.36	3.35
2	Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.33	3.35	3.34
3	Ability to work in a group on a major project	3.33	3.29	3.35
4	Ability to demonstrate understanding of the use of technical literature and other information sources	3.23	3.15	3.28
5	Ability to demonstrate practical engineering skills	3.15	3.14	3.18
…				
24	Ability to demonstrate knowledge and understanding of the commercial and economic context	2.78	2.72	2.81
25	Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.78	2.66	2.81
26	Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.74	2.76	2.73
27	Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.7	2.67	2.72
28	Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.61	2.53	2.68

There is general agreement on the ranking of the specific competences between the academic levels (Table 7.8) and between countries (Table 7.8(a) Appendix 1). In all cases core engineering competences are towards the top and entrepreneurial, multicultural and the more wider business competences towards the bottom.

7.5.2 Graduate perception of level of development of the specific competences

Table 7.9 shows, in descending order of magnitude, the top and bottom 5 mean level of development for the specific competences for all graduates and by academic level for which they answered the questionnaire. The lowest ranked competence has a mean of 2.16, between "weak" and "considerable". A full version of the table is shown in Appendix 1.

Table 7.9 Graduate perception of level of development of the specific competences by academic level

Rank	Specific competences	All	Bachelor	Master
1	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.16	3.05	3.23
2	Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	3.09	3.07	3.13
3	Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.02	3.04	3.04
4	Ability to demonstrate understanding of the use of technical literature and other information sources	2.93	2.85	3.02
5	Ability to work in a group on a major project	2.9	2.72	3
…				
24	Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.32	2.15	2.41
25	Ability to identify and manage cost drivers in designs and projects	2.3	2.12	2.38
26	Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.28	2.19	2.33
27	Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.25	2.07	2.31
28	Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.16	2.04	2.22

Table 7.9 shows similarity with the ranked importance in Table 7.8 with core engineering competences considered to be the best developed. As before the next subsection considers the gap in more detail.

7.5.3 Graduate perception of level of 'gap in the specific competences

As in the case of the generic competences the top and bottom 5 'gap' analysis is shown in Table 7.10 for all employers and by academic level. A full version of this table can be found in Appendix 1.

The top ranked gap for graduates, "Ability to identify and manage cost drivers in designs and projects", is the same as for employers and academics, a generally good alignment therefore exists at the very top. There is, however variation in the next few.

Table 7.10 Comparison of mean difference between rated importance and level of development of the specific competences for all graduates and by level of study.

Rank	Specific competence	All	Bachelor	Master
1	Ability to identify and manage cost drivers in designs and projects	0.61	0.76	0.53
2	Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.55	0.69	0.46
3	Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.52	0.64	0.45
4	Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	0.51	0.68	0.45
5	Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	0.48	0.69	0.42
…				
24	Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.3	0.34	0.29
25	Ability to demonstrate understanding of the use of technical literature and other information sources	0.29	0.31	0.26
26	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.22	0.29	0.23
27	Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.18	0.32	0.12
28	Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	-0.02	0.04	-0.06

As was the case in the generic competences, there is variation in the way graduates in different countries rate the gap between importance and level of development of the specific competences. The top ranked gap is:

- Bulgaria and Turkey: “Ability to identify and manage cost drivers in designs and projects”
- Greece: “Ability to identify and manage cost drivers in designs and projects” , “Ability to manage the design process and evaluate outcomes” (equal top)
- Ireland: “Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process”
- Poland: “Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement”
- Slovak Republic “Ability to work in a group on a major project”
- Spain: “Ability to demonstrate knowledge and understanding of the commercial and economic context”

Table 7.10(a) (Appendix 1) shows a full list of all the specific competence gaps for these countries.

8. The supply demand balance

8.1 Introduction

This section considers all the results and the analyses in the previous 4 sections to look in detail at the overall supply demand balance within the EIE discipline. The balance can be looked at in a number of different ways, by graduate level, by country or by type of type of competence. The approach adopted in this report is to look at the study level followed by competence type. A review by a small number of the countries is given where there are sufficient responses to make such a review meaningful.

8.2 The Bachelor level supply demand balance

8.2.1 General perception of preparedness for employment

Table 8.1 shows the mean overall responses to the question about whether the academic programme is or has prepared the student for employment. For students and academics this question is aimed at employment after graduation, for graduates and employers actual employment.

Table 8.1 General perception of preparedness for employment – overall means

	Male	Female	All
Student	2.52	2.58	2.53
Academic			2.19
Employer			2.26
graduate	2.31	2.59	2.37

From Table 8.1 it can be seen that academics are over-rating (mean = 2.19) their view of how well they are preparing Bachelor level students for employment relative to the employers (mean = 2.26). Students on the other hand, are under-rating their level of preparation (mean = 2.53) relative to employers. Males typically rate their preparation as being better than females. Graduates also under-rate their preparation for employment (mean = 2.37) relative to employers but not by as much as students still studying. This perhaps suggests they have had time after graduating to realise that their programme prepared them more than they expected as students.

Table 8.2 shows a country analysis where there is sufficient numbers of responses to allow a comparative analysis.

Table 8.2 General perception of preparedness for employment – overall means

Country	Students		Employers	Graduates
	Male	Female		
Bulgaria	2.40	2.57	2.00	
France	2.62	2.57	2.90	3.50
Greece	3.03	2.76		2.29
Ireland	2.24	1.60	1.50	1.70
Italy	2.85	2.50	3.00	2.57
Spain	2.71	2.87	2.33	2.45
Turkey	2.54	2.59	2.00	2.63

From an individual country perspective students from France and Italy think they are better prepared for employment than the employers in their own country. French graduates, on the other hand, rate themselves less prepared for employment then French employers. In all other countries (Bulgaria, Ireland, Spain and Turkey) students under-rate their preparation compared to employers.

8.2.2 The generic competences

Top of the list for importance of the generic competences for all four stakeholders is "Problem solving" (Table 4.5). The mean importance for bachelor level students is 3.43 while for academics it is 3.58, for employers 3.54 and for graduates 3.71. Student and graduate males tend to rate the importance more than females. Given the scale is 1 is weak and 4 strong, students are slightly under rating the importance of problem solving and academics slightly over rating it but the differences are not large enough to be of concern. Students rate the level of development of their problem solving competence at a mean of 2.89 while academics rate it at 2.97, employers 2.90 and graduates 3.07. Again there is good alignment between all stakeholders in the level of development of this competence. Table 8.3 (Appendix 1) shows a comparison of the mean of the generic competences across all stakeholder groups at the Bachelor level.

All students in general rank "Elementary computing skills" the second most important competence (Table 4.5). Both academics and employers rate this with a mean of 3.71. Comparatively students underrate the importance with a mean of 3.44. A possible explanation for this is that students tend to take elementary computing skills for granted. They also under rate the level of development (mean, male = 3.13, female = 3.19) compared to employers.

Four generic competences stand out as having a large difference between academics mean and the employers mean. The largest difference is in "Knowledge of a second language" (Academic mean = 3.15, Employer mean = 2.56). The others are "Critical and self-critical abilities" (Academic mean = 3.23, Employer mean = 2.85), "International relations and collaborations" (Academic mean = 2.83, Employer mean = 2.46), "Leadership" (Academic mean = 2.96, Employer mean = 2.59) and "Project design and management" (Academic mean = 3.38, Employer mean = 3.02). In all cases academics rate the competence as more important than employers. It is perhaps important to restate that the employers who engaged in this survey are mostly from large organisations and this perhaps explains these differences – large employers can afford to recruit graduates into specific, often technical, roles.

The difference between students and employers rating of importance varies even more widely with "Knowledge of a second language" being the greatest difference where students over-rate importance. Next over rated (relative to employers) is "International relations and collaborations" and then "Leadership". At the other end of the difference range is "Oral and written communications in native language" (student mean = 3.09, employer mean = 3.46), "Elementary computing skills" and "Appreciation of ethical issues" (student mean = 2.7, employer mean = 2.98). In these later cases the students over rate the importance of the competence relative to employers.

Table 6.1 shows the ranking of importance for employers. It is clear from the table that the responding employers are prioritising the competences of hands on technical activity work as most important and the general wider competences of business, internationalisation and entrepreneurialism as least. This would support the argument that the employers in this survey are, in the main looking for recruits to fill technical positions. Students rank the importance of the generic competences subtly differently and appear to be indicating a broader competence base.

To understand this in a different way a factor analysis of the generic competences was carried out to 'group' them. The 32 generic competences can be put into 5 groups:

Group 1: "*Internationalisation*"

1. Understanding of cultures and customs of other countries.
2. Appreciation of ethical issues.
3. Appreciation of diversity and multiculturality
4. International relations and collaborations
5. Ability to work in an international context

Group 2: "*Entrepreneurship*"

1. Patents and IPR.
2. Creativity
3. Initiative and entrepreneurial spirit

Group 3: "*Professional skills*"

1. Grounding in basic knowledge of the profession
2. Basic general technical knowledge
3. Capacity for analysis and synthesis
4. Research skills
5. Capacity to learn

Group 4: "*Interpersonal skills*"

1. Leadership
2. Interpersonal skills
3. Ability to communicate with non-experts
4. Oral and written communications in native language
5. Critical and self-critical capability
6. teamworking

Group 5: "*Personal skills*"

1. Ability to work autonomously
2. Problem solving
3. Capacity to adapt to new situations
4. Knowledge of a second language
5. Concern for quality
6. Will to succeed
7. Elementary computing skills
8. Capacity for applying knowledge in practice
9. Decision making
10. Project design and management
11. Information management skills

Table 8.4 shows the mean of each generic competence group for each stakeholder group. For the employers the personal skills are the most importance group followed by professional skills and interpersonal skills. The table confirms that employers rank internationalisation and entrepreneurship lowest. Academics agree with the order of the competence groups but rate all of them more strongly important than employers. Students also rank the competence groups in the same order but rate internationalisation slightly higher than employers and entrepreneurship very slightly lower.

Table 8.4 Mean of the importance of each generic competence group by stakeholder group

Generic competence group	Academic	Employer	Graduate	Student
Internationalization (Importance)	2.86	2.63	2.73	2.79
Entrepreneurship (importance)	3.07	3.05	3.04	3.02
Interpersonal skills (importance)	3.23	3.09	3.17	3.06
Professional skills (importance)	3.36	3.29	3.39	3.13
Personal skills (importance)	3.44	3.30	3.39	3.29

Table 8.5 in Appendix 1 shows the comparison of the level of development of all the individual generic competences across the stakeholder groups and Table 8.6 shows the mean of the level of development of each of the generic competence groups.

Table 8.6 Mean of the level of development of each generic competence group by stakeholder group

Generic competence group	Academic	Employer	Graduate	Student
Internationalization (Development)	2.42	2.39	2.19	2.24
Entrepreneurship (Development)	2.45	2.50	2.42	2.39
Interpersonal skills (Development)	2.67	2.64	2.58	2.51
Professional skills (Development)	3.08	3.00	2.99	2.76
Personal skills (Development)	2.90	2.86	2.82	2.75

Table 8.6 shows that there is good agreement that Professional skills are the best developed of the skill groups followed by Personal skills and Interpersonal skills. As with importance the Entrepreneurship and Internationalisation skill groups are developed the least. There is clearly a difference between the rated importance and level of development of these groups in that the Personal skills group is rated most important but the Professional skills group is developed the most. Other than that the general structure of the supply demand balance of the generic competences is quite well aligned.

At the detail level "Elementary computing skills" is rated highest in level of development by employers (Table 8.5 Appendix 1) with a mean of 3.61. Students (mean = 3.13) rate the level of development of this competence substantially lower. Academics (mean = 3.48) are more in line with the employers view.

Academics differ in their perception of level of development most from employers in "International relations and collaborations". The Academics (mean = 2.41) is substantially greater than employers (mean = 2.12), students are in the middle (mean = 2.31). So whilst no stakeholder group considers it to be an important competence academics do feel they develop it more than students and employers. Of more importance is "Project design and management" which is similarly rated higher in level of development by academics (mean = 2.88) than employers (mean = 2.63). In this competence students are in agreement with employers on the level of development. Why then do academics consider they develop the competence more than students and employers? Graduates (mean = 2.26) also support the over rating view of academics.

At the other end of the range academics rate the level of development of "Oral and written communications in your native language" (mean = 2.83) lower than employers (mean = 3.10). Unfortunately students rate the level of development even lower (mean = 2.68) Academic can take some comfort in this outcome. Similarly other competences where academics rate the level of development lower than employers include "Ability to communicate with non-experts", "Appreciation of ethical issues", "Initiative and entrepreneurial spirit" and "Will to succeed".

Students can take comfort in the result that shows employers rate the level of development of a number of competences more strongly than they do. Amongst these are "Elementary computing skills", "Grounding in basic knowledge of the profession of your work area", "Appreciation of ethical issues" and "Capacity for analysis and synthesis".

Turning now to the gap analysis. Table 8.7 (Appendix 1) shows the comparison of the gap of all the individual generic competences across the stakeholder groups. The largest gaps between rated importance and level of development for employers are (in decreasing magnitude order):

1. Teamworking
2. Concern for quality
3. Capacity for generating new ideas (creativity)
4. Problem solving
5. Decision making
6. Planning and time management

In contrast to this list both academics and students feel that "Knowledge of a second language" has the largest difference between rated importance and level of development.

8.2.3 The language competences

As has already been shown the English language is the only language that merits further analysis by all stakeholder groups. Table 8.8 shows the stakeholder views on the English language at the Bachelor level.

Table 8.8 Stakeholder views on the English language

	Academic	Employer	Graduate	Student
Importance of written	3.63	3.37	3.53	3.35
Importance of spoken	3.59	3.50	3.42	3.36
Level of development of written	2.77	2.97	2.81	2.74
Level of development of spoken	2.75	2.89	2.64	2.69

Table 8.8 shows that students and employers value the importance of written ability in English lower than academics and graduates. Employers consider ability in spoken English to be more important. Academics feel both written and spoken English is an important capability in their Bachelor level students a finding which aligns with the higher rating of importance of the internationalisation generic competence group. Students appear to be under-rating their perception of the importance and level of development of their English ability.

It is worth noting that academics consider written English to be more important than spoken English whereas it is the other way round for employers. This may be a result of the specific needs of the majority employer group in this survey (large organisations).

Overall These results suggests that the importance of both written and spoken English could be usefully increased in students to be more in line with needs.

8.2.4 The specific competences

Table 8.9 (Appendix 1) shows the mean importance of each specific competence for all four stakeholders at the Bachelor level. The table shows that employers rate the most importance specific competence as "Ability to demonstrate understanding of the use of technical literature and other information sources" (mean = 3.47). Academics rank this 7th in their priority list (mean = 3.33) and students 10th (mean = 2.99). These results show that both academics and in particular students are under-rating the importance of this competence to employers.

The second most important specific competence for employers is "Ability to demonstrate awareness of quality issues" (mean = 3.44). This aligns well with the importance of concern for quality as indicated in the generic competences list for employers. Academics rank this 8th (mean = 3.33) and students 21st (mean = 2.85). Here again students and to a lesser extent academics are under-rating the importance of this competence for employers.

In all but one of the specific competences ("Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues") students are under-rating their importance relative to employers. This could be a result of employers generally rating higher than students although calculating the average of all the means for each stakeholder group shows the highest average to be academics (3.18) followed by employers (3.17) then students (2.96) and graduates (2.95). From this employers and academics are rating competences higher than students and graduates on average. Even taking this difference in average rating into account does not change the above conclusions.

Considering the difference between the mean for employers and students the largest difference is in "Ability to demonstrate awareness of quality issues" followed by "Ability to demonstrate understanding of the use of technical literature and other information sources". As shown above these are also the top 2 most important competences for employers so this is an important outcome and it suggests effort needs to be directed to increasing student awareness of the importance of these competences of future employment.

Table 8.10 (Appendix 1) shows the mean level of development of each specific competence for all four stakeholders at the Bachelor level. Employers rate "Ability to demonstrate understanding of the use of technical literature and other information sources" (mean = 3.19) as the most developed competence as they

do its importance. This is an encouraging outcome from a supply demand balance viewpoint. Academics rank this competence lower in 6th position (mean = 2.97) and students 8th (mean = 2.61).

As with the rating of importance, employers and academics typically score the competences higher than students and graduates. Even allowing for the differences in mean responses across the stakeholder groups there are still differences in the mean rating of level of development. The largest differences between academics and employers are in:

- Ability to demonstrate understanding of the use of technical literature and other information sources
- Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering
- Ability to demonstrate understanding of appropriate codes of practice and industry standards
- Ability to demonstrate awareness of the nature of intellectual property and contractual issues
- Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal

where employers rate the level of development higher than academics and:

- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
- Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline
- Ability to work in a group on a major project

where academics rate the level of development higher than employers. It is perhaps in this later group where a useful result emerges.

In a similar comparison between students and employers, employers rate the development of the following competences higher than students:

- Ability to demonstrate understanding of the use of technical literature and other information sources
- Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering
- Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal
- Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)
- Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs
- Ability to demonstrate knowledge and understanding of the commercial and economic context
- Ability to demonstrate practical engineering skills

and students over rate the following competences compared to employers:

- Ability to apply a systems approach to engineering problems
- Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement
- Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline
- Ability to identify and manage cost drivers in designs and projects

- Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques

Work can be done in enhancing the development of those competences where the employer rates the level of development lower than the students as these represent a shortfall in need from the demand side of the supply demand balance.

Considering the gap between rated importance and level of development for each competence, Table 8.11 (Appendix 1) shows the gap for all stakeholders. For employers the largest gaps are in:

- Ability to identify and manage cost drivers in designs and projects
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques
- Ability to demonstrate awareness of quality issues
- Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement
- Ability to demonstrate understanding of appropriate codes of practice and industry standards
- Ability to manage the design process and evaluate outcomes

All gaps indicate that employers rate the competence more importantly than they rate the level of development. As shown in Table 8.11 all the specific competence gaps are positive indicating employers consider all m ore important than they are developed. In all cases therefore, there is a gap that could be usefully reduced.

Academics see the gap subtly differently to employers with the following as top of their gap list:

- Ability to demonstrate understanding of appropriate codes of practice and industry standards
- Ability to identify and manage cost drivers in designs and projects
- Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues
- Ability to demonstrate awareness of the nature of intellectual property and contractual issues
- Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering

Students again see the gap differently, their top list is:

- Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process
- Ability to identify and manage cost drivers in designs and projects
- Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs
- Ability to work in a group on a major project
- Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development

These differences may be accounted for in the differing expectations of the type of employment expected of the stakeholders. In all cases though there exist gaps in the supply demand balance, which could usefully be narrowed. Table 8.11 provides the information to enable the important gaps to be identified for each stakeholder group and hence where the focus of attention should be for curriculum changes.

8.3 The Masters level supply demand balance

8.3.1 General perception of preparedness for employment

Table 8.12 shows the mean overall responses to the question about whether the academic programme is or has prepared the student for employment. For students and academics this question is aimed at employment after graduation, for graduates and employers actual employment.

Table 8.12 General perception of preparedness for employment – overall means

	Male	Female	All
Student	2.52	2.44	2.51
Academic			1.88
Employer			2.22
Graduate	2.16	1.94	

From Table 8.12 it can be seen that academics are over-rating (mean = 1.88) their view of how well they are preparing Master level students for employment relative to the employers (mean = 2.22). Students on the other hand, are under-rating their level of preparation (mean = 2.51) relative to employers. Males typically rate their preparation as being lower than females. Graduates also over-rate their preparation for employment relative to employers.

8.3.2 The generic competences

Table 8.13 (Appendix 1) shows the importance of the generic competences for all four stakeholders at the Masters level. Top of the rated list for employers is "Teamworking" followed by "Problem solving", "Concern for quality" and "Capacity for applying knowledge in practice".

As at the Bachelor level employers have, on average, rated the importance of generic competences higher than the other three stakeholders. Even taking this difference into account neither students nor academics rate "Teamworking" as highly as employers. This suggests a difference in the perception of need for this competence in employment. A more general look at Table 8.13 reveals a number of competences where students under-rate its importance relative to employers, these include:

- Concern for quality
- Oral and written communications in native language
- Appreciation of ethical issues
- Capacity to learn
- Basic general technical knowledge of the profession of your work area
- Capacity for applying knowledge in practice
- These are all areas where a greater emphasis could be placed in the academic programme.

Table 8.14 (Appendix 1) shows the level of development of the generic competences for all four stakeholders at the Masters level. A look at the average of all the means for each stakeholder groups shows that for level of development students over-rate the level of development compared to employers whereas they under rate the importance of generic competences. Academics underrate both importance and level of development and are hence less positive in both respects. On the basis of this academics can be more positive in their views of both the importance and their level of development in the generic competences in their academic programmes.

Table 8.14 shows that employers consider a number of competences to be being developed greater than students rate them as being, these include:

- Oral and written communication in your native language

- Understanding of cultures and customs of other countries
- Appreciation of diversity and multiculturality
- Ability to work in an international context
- Appreciation of ethical issues

Students can be more confident in these competences. However, there are also competences in which employers do not rate the level of development as high as students, in these students may be over confident in their ability, the most significant of these are:

- Ability to work autonomously
- Planning and time management
- Decision making
- Leadership
- Project design and management
- Patents and Intellectual Property Rights

An analysis of the generic competences by group (see section 8.2.2) is also considered to show how the importance varies between stakeholders. Table 8.15 shows the mean of the rated importance of each generic competence group for each stakeholder group and Table 8.16 the level of development.

Table 8.15 Mean of the importance of each generic competence group by stakeholder group

Generic competence group	Academic	Employer	Graduate	Student
Internationalization (Importance)	2.66	2.94	2.78	2.89
Entrepreneurship (importance)	2.96	3.06	3.00	3.15
Interpersonal skills (importance)	3.04	3.26	3.04	3.14
Professional skills (importance)	3.36	3.31	3.28	3.19
Personal skills (importance)	3.36	3.47	3.32	3.41

As was the case at the Bachelor level, for employers the personal skills are the most importance group followed by professional skills and interpersonal skills. The table confirms that employers rank internationalisation and entrepreneurship lowest. Academics agree with the order of the competence groups. Students rank entrepreneurship slightly higher than interpersonal skills which may be a reflection of the type of employment graduates has or their difficulties in gaining employment and an attendant desire to look to entrepreneurship as a route for the future.

Table 8.16 Mean of the level of development of each generic competence group by stakeholder group

Generic competence group	Academic	Employer	Graduate	Student
Internationalization (Development)	2.30	2.49	2.35	2.32
Entrepreneurship (Development)	2.35	2.49	2.49	2.55
Interpersonal skills (Development)	2.49	2.68	2.68	2.64
Professional skills (Development)	2.92	2.85	3.03	2.89
Personal skills (Development)	2.84	2.82	2.94	2.89

Table 8.6 shows that there is good agreement that Professional skills are the best developed of the skill groups followed by Personal skills and Interpersonal skills. As with importance the Entrepreneurship and Internationalisation skill groups are developed the least. There is clearly a difference between the rated importance and level of development of these groups in that the Personal skills group is rated most

important but the Professional skills group is developed the most. Other than that the general structure of the supply demand balance of the generic competences is quite well aligned.

Turning now to the gap analysis. Table 8.17 (Appendix 1) shows the comparison of the gap of all the individual generic competences across the stakeholder groups. The largest gaps between rated importance and level of development for employers are (in decreasing magnitude order):

- Concern for quality
- Planning and time management
- Capacity for applying knowledge in practice
- Capacity to adapt to new situations
- Problem solving
- Ability to work autonomously

As with the importance, all the gaps are positive indicating that the level of development is below the rated importance of each competence. The gaps are also large, all being greater than 0.75 on a 0 to 3 range. In contrast to this list academics rank the following as the top 5 gaps:

- Ability to work in an interdisciplinary team
- Knowledge of a second language
- Initiative and entrepreneurial spirit
- Oral and written communication in your native language
- Concern for quality

While students top five is:

- Knowledge of a second language
- Ability to work in an international context
- Capacity for generating new ideas (creativity)
- Capacity for applying knowledge in practice
- International Relations and Collaborations

These lists clearly show very different perceptions at the Masters level. A possible explanation for this are the different paths Masters level students will take in their future careers. The employers list is focussed on more conventional work activities whereas the student list is more general and international in its content. The academics list is also more general but perhaps more general purpose in the utility of the competences that employers.

8.3.3 The language competences

As has already been shown the English language is the only language that merits further analysis by all stakeholder groups. Table 8.18 shows the stakeholder views on the English language at the Masters level.

Table 8.18 Stakeholder views on the English language

	Academic	Employer	Graduate	Student
Importance of written	3.71	3.55	3.45	3.47
Importance of spoken	3.63	3.61	3.41	3.49
Level of development of written	2.86	2.87	2.81	2.70
Level of development of spoken	2.81	3.00	2.76	2.66

Table 8.18 shows that students and employers value the importance of written ability in English lower than academics. Employers consider ability in written English to be more important than spoken, the reverse of the Masters level view. Academics feel both written and spoken English is an important capability in their Masters level students a finding which aligns with the higher rating of importance of the internationalisation generic competence group. Students appear to be under-rating their perception of the importance and level of development of their English ability.

It is worth noting that academics consider written English to be more important than spoken English whereas it is the other way round for employers. This may be a result of the specific needs of the majority employer group in this survey (large organisations).

As with the case for Bachelor level students, overall these results suggests that the importance of both written and spoken English could be usefully increased in Masters level students to be more in line with needs.

8.3.4 The specific competences

Table 8.19 (Appendix 1) shows the mean importance of each specific competence for all four stakeholders at the Masters level. The table shows that employers rate the most importance specific competence as "Ability to demonstrate awareness of quality issues" (mean = 3.23). This aligns well with employers rating of importance in concern for quality as a generic competence. Academics rank this 9th in their priority list but with a higher mean importance (mean = 3.27) and students 25th out of 28 (mean = 2.89). These results show that students are very noticeably under-rating the importance of this competence to employers.

The second most important specific competence for employers is "Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process" (mean = 3.20). Academics rank this 17th (mean = 3.06) and students 5th (mean = 3.25). Students rate this competence more important than both employers and academics. A look at the overall mean of the responses within each stakeholder group does, however reveal that academics and students are rating the importance of the specific competences higher than graduates and, in particular, employers. Allowing for this difference reverses the above result and shows students rate "Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process" as less important than do employers.

In contrast to "Ability to demonstrate awareness of quality issues" in which employers rate its importance greater than students, students rate a number of competences more important than employers, the larger of these are:

- Ability to manage the design process and evaluate outcomes
- Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems
- Ability to demonstrate practical engineering skills
- Ability to work in a group on a major project
- Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline
- Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques

Again this difference is possibly explainable by the different expectations of work at the Masters level.

Table 8.20 (Appendix 1) shows the mean level of development of each specific competence for all four stakeholders at the Bachelor level. Employers rate "Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline" (mean = 2.97) as the most developed competence. Academics rank this competence lower in 2nd position (mean = 3.01) and students 3rd (mean = 2.96).

On average students are rating the development of specific competences higher than both employers and academics. Graduates rate even higher than students. Academics also rate the importance higher than employers. Even allowing for the differences in mean responses across the stakeholder groups there are still

differences in the mean rating of level of development. The largest differences between employers and students are in:

- Ability to manage the design process and evaluate outcomes
- Ability to identify and manage cost drivers in designs and projects"
- Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)
- Ability to work in a group on a major project
- Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline
- Ability to demonstrate understanding of appropriate codes of practice and industry standards
- Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development
- Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products

where employers rate the level of development lower than students and:

- Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement
- Ability to demonstrate awareness of quality issues

where employers rate the level of development higher than students. It is in the first group where a useful result emerges and thought at the curriculum development level needs to be given. Work can be done in enhancing the development of those competences where the employer rates the level of development lower than the students as these represent a shortfall in need from the demand side of the supply demand balance.

Considering the gap between rated importance and level of development for each competence, Table 8.21 (Appendix 1) shows the gap for all stakeholders. For employers the largest gaps are in:

- Ability to identify and manage cost drivers in designs and projects
- Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues
- Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)
- Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process
- Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products

All gaps indicate that employers rate the competence more importantly than they rate the level of development. As shown in Table 8.21 all the specific competence gaps are positive indicating employers consider all m ore important than they are developed. In all cases therefore, there is a gap that could be usefully reduced. Of significant note is the magnitude of the gap. For "Ability to identify and manage cost drivers in designs and projects" the gap is 1.03 on a range of 0 to 3 – this is a very large gap.

For academics the competences with the largest gaps are:

- Ability to apply a systems approach to engineering problems
- Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles
- Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process

- Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal
- Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs

Students again see the gap differently, their top list is:

- Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process
- Ability to identify and manage cost drivers in designs and projects
- Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues
- Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs
- Ability to work in a group on a major project

There are some commonalities in the views but also some differences that merit further investigation. Table 8.21 provides the information to enable the important gaps to be identified for each stakeholder group and hence where the focus of attention should be for curriculum changes.

9. Conclusions and recommendations

The objective of this study was to apply the Tuning Methodology to the EIE discipline set to test the alignment between the views of the importance and level of development of sets of competences between students, academics, employers and graduates. The results of this study show that the Tuning Methodology is a useful tool for assessing alignment in these subjects.

In total 3,275 questionnaires have been collected from the four stakeholder groups from a range of European countries. The number of responses from each country is variable and a full by country analysis is not possible with the responses currently available, that said a range of analyses have been carried out and are reported herein. It is expected that the analysis will be an ongoing activity for the EAEEIE as might the collection of additional data to fill in some of the gaps in the data set as it currently stands. This report should, therefore be read not as the last and final analysis of the task but as a summary of the findings and analysis undertaken up to the end of the project funding period.

Tests of the homogeneity of the responses across all countries show that there are country differences in some analyses and some of these are explored in this report, others merit further investigation. Many of the analyses presented in this report are aggregated results and therefore potentially suffer clustering problems. This too is a topic of further investigation on an ongoing basis and updates to this report and the research findings that emerge will be made available.

The survey permits many different analysis options such as by study level, gender, country, competence (individually and by group) and all combinations of these dimensions. The following is a summary of the key conclusions drawn form the analyses presented in this report.

On the question of general preparedness for employment, at the Bachelor and Masters levels, academics typically over-rate their view of how well they are preparing students for employment relative to employers of their graduates. Students, on the other hand, generally underrate their preparation. There are two notable country exceptions to this though. Undergraduates from France and Italy consider they are better prepared for employment than the employers in their country. There is clearly an opportunity here to build the confidence of students in their perception of the level of preparedness.

Consistent top of importance of the generic competences for all four stakeholders is “Problem solving”. Second in the ranking for students is “Elementary computing skills”. Comparatively students under rate the importance of this skill, perhaps it is taken for granted in students than in academics and employers. The results show employers value it more than students and this message could be communicated to students.

A number of gaps exist between the importance and level of development between the stakeholders. The largest gap is “Knowledge of a second language” and the evidence from the languages section suggests this view is strongly aimed at English.

The generic competences group into 5 sets with “Personal skills” rated consistently as the most important set. This is followed, in descending order of importance, by “Professional skills”, “Interpersonal skills”, “Internationalisation” and “Entrepreneurship”. The smallest mean “Internationalisation” is just over midway between “weak” and “considerable”. Given the European Union’s desire to see greater student and employee mobility across Europe, it is clear there is scope for scope for improvement in the value placed in this skill set by curriculum designers.

Curriculum designers and academics can take comfort in the finding that “Professional skills” are the best developed of the skill groups followed by “Personal skills” and “Interpersonal skills”. This not only aligns with the views of employers but aligns with anecdotal views on the real purpose of EIE education programmes. That said there is a trend in a number of countries across Europe away from large firm employment towards a Small to Medium Sized Enterprise culture. Curriculum designers may wish to reflect on the fact that entrepreneurial skills are very low in the list and perhaps merit more attention and emphasis in the curricula.

In general the different stakeholders rate the importance and level of development on average differently. This difference has been taken into account in the conclusions drawn. The general unevenness in ranking reflects different perspectives and is, in itself not considered a major issue, of concern are the relative positions of competences and the relative gaps. In general and even allowing for this employers and

academics tend to rate competences higher in importance than students and graduates a number of specific instances of differences are drawn out in section 8.

In response to the questions on languages English is the only one other than the respondent's native language, that scores above "weak' in importance for all stakeholders. German is the closest second language. For all stakeholders there is a positive gap between rated importance and level of development indicating that students needs are not currently being met by their academic programmes. This gap is greatest at Masters level, a finding also shown by employers, and in general males consider English to be more important and more well developed than females. It is worth noting that academics consider written English to be more important than spoken English whereas it is the other way round for employers. This may be a result of the specific needs of the majority employer group in this survey (large organisations). Overall These results suggests that the importance of both written and spoken English could be usefully increased in students to be more in line with needs.

The responses to the specific competence questions show a greater diversity of means and gaps although as with the generic competences some common themes emerge. Top for all stakeholder groups are the more core engineering oriented competences such as "Ability to demonstrate understanding of the use of technical literature and other information sources" and "Ability to demonstrate awareness of quality issues", the later being of particular importance to employers and which aligns with their view that "Concern for quality" is one of the most important generic competences. Bottom of the ranked importance list for employers are again the broader activities relating to internationalisation and entrepreneurship. This is perhaps understandable knowing that the majority of the employers are from large organisations who can perhaps afford to employ EIE graduates into more tightly focussed engineering positions. With the move towards an SME employment base in some countries across Europe this may need to change and a lessening of the gaps between the core technical and the broader engineering competences may be needed. Curriculum designers are encouraged to look at the specific situation in their country to see to what level this adjustment may be needed. The country specific data available in this report should provide some evidence to help in such a review.

The value of the Tuning Methodology and of the analyses carried out has been demonstrated by this project task and the specific findings point clearly to areas where more work can be undertaken. There are gaps in the data for some countries and for some stakeholder groups within some countries. It is recommended that attempts are made to fill these gaps so that the analysis can be extended to be more representative of the whole of Europe. The issue of clustering needs to be examined in more detail and a focussed study in this area may reveal some interesting European country clusters or some regional differences. A plan for the targeted collection of more results is being drawn up to further this objective.

Finally, it is anticipated that the dataset will continue to be explored and publications produced on specific themed analyses of it in the near future.

Appendix 1 – Data Tables

Appendix 1 contains the data tables for the figures in the main report and complete tables for all the analyses including by country tables where the number of responses available make the results meaningful.

Some additional information is provided in the data tables where appropriate, see notes below each table.

Table 3.1. Distribution of returns by questionnaire type.

Questionnaire type	Number of questionnaires	Percentage	Target
Academic	189	5.7%	4%
Employer	112	3.4%	7%
Graduate	326	9.8%	18%
Student	2691	81.1%	71%
Total	3318	100.0%	100%

Table 3.3 Distribution of responses by gender.

	Male		Female	
Academic	151	82.1%	33	17.9%
Employer	103	92.0%	9	8.0%
Graduate	252	77.5%	73	22.5%
Student	2259	85.5%	382	14.5%

Table 3.4. Distribution of student responses by country

Country	Gender			Total
	Male	Female	% Female	
Austria		2		2
Belgium		2		2
Bulgaria	122	67	35.4	189
Cyprus	3			3
Czech Republic	2	1		3
Demark	2			2
Estonia	72	12	14.2	84
Finland		1		1
France	313	28	8.2	341
Germany	4	1		5
Greece	187	52	21.8	239
Hungary	200	20	9.1	220
Iceland	4	1		5
Ireland	106	6	5.3	113
Italy	83	10	10.8	93
Latvia	45	19	29.7	64
Lithuania	1			1
Poland	222	15	6.3	237
Portugal	70	5	6.7	75
Romania	6	6		12
Slovak Republic	362	27	6.9	389
Slovenia	7			7
Spain	95	45	32.1	140
Sweden		1		1
Turkey	138	51	27.0	189
United Kingdom	201	5	2.4	206
Total	2245	377	14.4	2623

Table 3.5. Distribution of student responses by level of study

Level of study	Gender			Total
	Male	Female	% Female	
Bachelor	1658	271	14.0	1930
Masters	550	95	14.7	645
Doctoral/PhD	16	7	30.4	23
Total	2224	373	14.4	2598

Table 3.6. Distribution of student responses by age band

Age band	Gender			Total
	Male	Female	% Female	
20 or under	931	85		1016
21-30	1303	290	1	1594
31-40	10	4		14
41-50	8	2		10
over 61	2	1		3
Total	2254	382	1	2637

Table 3.7. Distribution of academic responses by country

Country	Frequency	Percent
Belgium	1	0.5
Bulgaria	10	5.3
Cyprus	4	2.1
Czech Republic	1	0.5
Estonia	6	3.2
France	15	7.9
Germany	1	0.5
Greece	15	7.9
Ireland	12	6.3
Italy	8	4.2
Latvia	4	2.1
Lithuania	8	4.2
Poland	11	5.8
Portugal	7	3.7
Romania	1	0.5
Slovak Republic	20	10.6
Spain	34	18
Turkey	14	7.4
United Kingdom	10	5.3
Missing	7	3.7
Total	189	100

Table 3.8. Distribution of employer responses by country

Country	Frequency	Percent
Bulgaria	20	17.9
Czech Republic	2	1.8
France	13	11.6
Germany	12	10.7
Ireland	18	16.1
Italy	3	2.7
Latvia	2	1.8
Poland	13	11.6
Portugal	4	3.6
Slovak Republic	7	6.3
Spain	11	9.8
Turkey	7	6.3

Table 3.9. Distribution of graduate responses by country

Country	Frequency	Percent
Belgium	2	0.6
Bulgaria	50	15.2
Czech Republic	2	0.6
Demark	1	0.3
Estonia	2	0.6
Finland	1	0.3
France	5	1.5
Germany	2	0.6
Greece	31	9.4
Ireland	18	5.5
Italy	10	3
Latvia	3	0.9
Norway	1	0.3
Poland	29	8.8
Portugal	13	4
Slovak Republic	63	19.1
Slovenia	1	0.3
Spain	38	11.6
Turkey	33	10

Table 4.1 Mean student response to "Do you feel that the degree programme is preparing you adequately for employment?" by level and gender.

Level	Male	Female	Total
Bachelor	2.52	2.58	2.53
Master	2.52	2.44	2.51
Doctoral	2.07[*1]	1.33[*2]	1.86[*3]
Total	2.52	2.54	2.53

*Notes: [*1] n=15; [*2] n=6; [*3] n=21*

Table 4.2 Mean student response to "Do you feel that the degree programme is preparing you adequately for employment?" by country.

Country	All	Male	Female
Bulgaria	2.33	2.25	2.43
Estonia	2.38	2.4	2.25
France	2.57	2.58	2.43
Greece	2.97	3.02	2.77
Hungary	2.08	2.05	2.44
Ireland	2.22	2.25	1.67
Italy	2.74	2.75	2.6
Latvia	2.89	2.87	2.95
Poland	2.5	2.5	2.54
Portugal	2.51	2.51	2.6
Slovak Republic	2.58	2.58	2.48
Spain	2.8	2.76	2.89
Turkey	2.43	2.44	2.4
United Kingdom[*1]	1.94	1.88	3
Total	2.53	2.52	2.55

*Notes: [*1] Computer Science students only*

Table 4.4 Difference between "Do you feel that the degree programme is preparing you adequately for employment?" and "How would you rate the employment potential of your degree?" by country.

Country	All	Male	Female
Bulgaria	0.17	0.19	0.13
Estonia	-1.88	-1.83	-2.17
France	-0.47	-0.45	-0.71
Greece	0.35	0.37	0.27
Hungary	0.12	0.14	0
Ireland	-2	-1.95	-3.16
Italy	0.43	0.41	0.5
Latvia	0.46	0.43	0.53
Poland	0.18	0.17	0.31
Portugal	-1.48	-1.49	-1.2
Slovak Republic	0.18	0.17	0.29
Spain	0.71	0.73	0.66
Turkey	0.11	0.09	0.15
United Kingdom	-2.3	-2.43	0
Total	-0.11	-0.14	0.01

Table 4.5 All student rating of importance of the generic competences.

Generic competence	N	Mean	Std. Deviation
Problem solving – Importance	2481	3.48	0.752
Elementary computing skills – Importance	2480	3.44	0.785
Capacity for applying knowledge in practice – Importance	2486	3.41	0.758
Teamworking – Importance	2487	3.41	0.754
Will to succeed – Importance	2478	3.36	0.811
Capacity to adapt to new situations – Importance	2483	3.33	0.764
Capacity for generating new ideas (creativity) – Importance	2483	3.33	0.806
Capacity to learn – Importance	2487	3.32	0.774
Decision making – Importance	2481	3.29	0.791
Ability to work autonomously – Importance	2470	3.28	0.81
Concern for quality – Importance	2477	3.27	0.816
Basic general technical knowledge of the profession of your work area – Importance	2483	3.24	0.797
Capacity for analysis and synthesis – Importance	2488	3.23	0.761
Information management skills – Importance	2483	3.22	0.813
Project design and management – Importance	2481	3.21	0.824
Knowledge of a second language – Importance	2482	3.19	0.956
Planning and time management – Importance	2482	3.14	0.815
Interpersonal skills – Importance	2481	3.11	0.803
Oral and written communication in your native language – Importance	2484	3.1	0.886
Ability to work in an international context – Importance	2479	3.09	0.868
Grounding in basic knowledge of the profession of your work area – Importance	2480	3.06	0.813
Initiative and entrepreneurial spirit – Importance	2477	3.04	0.832
Ability to work in an interdisciplinary team – Importance	2472	3.01	0.849
Ability to communicate with non-experts (in the field) – Importance	2483	3	0.867
Research skills –Importance	2478	2.99	0.854
Critical and self-critical abilities – Importance	2475	2.97	0.81
Leadership – Importance	2487	2.95	0.827
International Relations and Collaborations – Importance	2475	2.92	0.91
Patents and Intellectual Property Rights – Importance	2476	2.79	0.948
Appreciation of ethical issues – Importance	2480	2.72	0.946
Appreciation of diversity and multiculturality – Importance	2482	2.71	0.936
Understanding of cultures and customs of other countries – Importance	2474	2.52	0.973

Table 4.6 Weighted ranking of importance of generic competences by Bachelor level students

Generic Competence	Score
Problem solving	1823
Teamworking	1624
Capacity for applying knowledge in practice	1584
Knowledge of a second language	1231
Capacity for analysis and synthesis	1176
Capacity to learn	1094
Basic general technical knowledge of the profession of your work area	997
Will to succeed	911
Capacity for generating new ideas (creativity)	887
Capacity to adapt to new situations	760
Decision making	729
Elementary computing skills	708
Planning and time management	685
Research skills	640
Ability to work autonomously	598
Leadership	593
Concern for quality	467
Project design and management	466
Oral and written communication in your native language	465
Grounding in basic knowledge of the profession of your work area	434
Interpersonal skills	357
Ability to work in an international context	317
Critical and self-critical abilities	302
Ability to work in an interdisciplinary team	260
Initiative and entrepreneurial spirit	239
Ability to communicate with non-experts (in the field)	217
Information management skills	214
International Relations and Collaborations	167
Appreciation of ethical issues	148
Understanding of cultures and customs of other countries	129
Appreciation of diversity and multiculturality	115
Patents and Intellectual Property Rights	60

Table 4.7 All student rating of level of development of the generic competences.

Generic competence	N	Mean	Std. Deviation
Elementary computing skills – Level	2479	3.2	0.862
Problem solving – Level	2479	2.97	0.862
Capacity to learn – Level	2481	2.96	0.876
Teamworking – Level	2484	2.94	0.921
Basic general technical knowledge of the profession of your work area – Level	2479	2.91	0.848
Ability to work autonomously – Level	2469	2.91	0.89
Capacity for analysis and synthesis – Level	2481	2.85	0.762
Will to succeed – Level	2475	2.82	0.946
Capacity for applying knowledge in practice – Level	2480	2.81	0.815
Grounding in basic knowledge of the profession of your work area – Level	2475	2.79	0.845
Information management skills – Level	2475	2.79	0.878
Concern for quality – Level	2475	2.77	0.947
Capacity to adapt to new situations – Level	2477	2.73	0.903
Decision making – Level	2480	2.72	0.903
Oral and written communication in your native language – Level	2478	2.71	0.979
Project design and management – Level	2476	2.71	0.888
Research skills – Level	2475	2.63	0.902
Capacity for generating new ideas (creativity) – Level	2479	2.61	0.949
Interpersonal skills – Level	2479	2.6	0.913
Planning and time management – Level	2477	2.59	0.919
Critical and self-critical abilities – Level	2472	2.52	0.909
Ability to communicate with non-experts (in the field) – Level	2480	2.45	0.956
Initiative and entrepreneurial spirit – Level	2476	2.44	0.89
Ability to work in an interdisciplinary team – Level	2470	2.43	0.939
Knowledge of a second language – Level	2477	2.42	0.996
Ability to work in an international context – Level	2475	2.35	0.978
Appreciation of diversity and multiculturality – Level	2475	2.31	0.984
Leadership – Level	2482	2.3	0.914
International Relations and Collaborations – Level	2469	2.3	0.998
Appreciation of ethical issues – Level	2473	2.29	1.001
Patents and Intellectual Property Rights – Level	2468	2.27	1
Understanding of cultures and customs of other countries – Level	2470	2.03	0.973

Table 4.8 Comparison of mean difference between rated importance and level of development for all students by gender.

Generic competence	All	Male	Female
Knowledge of a second language	0.79	0.78	0.81
Ability to work in an international context	0.76	0.77	0.72
Capacity for generating new ideas (creativity)	0.74	0.74	0.77
Leadership	0.67	0.69	0.61
Capacity for applying knowledge in practice	0.63	0.62	0.69
International Relations and Collaborations	0.63	0.64	0.57
Capacity to adapt to new situations	0.62	0.62	0.66
Initiative and entrepreneurial spirit	0.62	0.62	0.63
Ability to work in an interdisciplinary team	0.6	0.61	0.56
Decision making	0.59	0.6	0.54
Planning and time management	0.57	0.56	0.64
Ability to communicate with non-experts (in the field)	0.56	0.57	0.53
Will to succeed	0.55	0.55	0.58
Problem solving	0.54	0.54	0.54
Concern for quality	0.53	0.52	0.63
Interpersonal skills	0.52	0.53	0.47
Project design and management	0.51	0.52	0.52
Patents and Intellectual Property Rights	0.51	0.52	0.46
Understanding of cultures and customs of other countries	0.5	0.5	0.5
Teamworking	0.49	0.5	0.4
Critical and self-critical abilities	0.45	0.46	0.43
Information management skills	0.44	0.43	0.49
Appreciation of ethical issues	0.42	0.42	0.48
Appreciation of diversity and multiculturality	0.41	0.42	0.37
Capacity for analysis and synthesis	0.4	0.4	0.42
Oral and written communication in your native language	0.4	0.4	0.38
Capacity to learn	0.38	0.38	0.37
Ability to work autonomously	0.38	0.38	0.41
Research skills	0.37	0.36	0.42
Basic general technical knowledge of the profession of your work area	0.34	0.33	0.43
Grounding in basic knowledge of the profession of your work area	0.28	0.26	0.39
Elementary computing skills	0.25	0.25	0.26

Table 4.9 Comparison of mean difference between rated importance and level of development for all students by level of study.

Generic competence	Bachelor	Master
Knowledge of a second language	0.76	0.88
Capacity for generating new ideas (creativity)	0.76	0.72
Ability to work in an international context	0.75	0.83
Leadership	0.69	0.66
Ability to work in an interdisciplinary team	0.64	0.49
Capacity to adapt to new situations	0.63	0.61
Initiative and entrepreneurial spirit	0.63	0.61
International Relations and Collaborations	0.61	0.7
Decision making	0.6	0.6
Capacity for applying knowledge in practice	0.59	0.72
Will to succeed	0.59	0.48
Planning and time management	0.57	0.59
Ability to communicate with non-experts (in the field)	0.56	0.57
Concern for quality	0.55	0.49
Problem solving	0.54	0.53
Interpersonal skills	0.53	0.52
Patents and Intellectual Property Rights	0.53	0.48
Understanding of cultures and customs of other countries	0.52	0.47
Project design and management	0.51	0.53
Teamworking	0.5	0.48
Information management skills	0.46	0.4
Critical and self-critical abilities	0.46	0.45
Appreciation of ethical issues	0.44	0.42
Ability to work autonomously	0.43	0.27
Oral and written communication in your native language	0.42	0.36
Capacity to learn	0.42	0.27
Appreciation of diversity and multiculturality	0.42	0.41
Capacity for analysis and synthesis	0.41	0.38
Research skills	0.4	0.28
Basic general technical knowledge of the profession of your work area	0.37	0.29
Grounding in basic knowledge of the profession of your work area	0.28	0.27
Elementary computing skills	0.28	0.2

Table 4.10 Comparison of mean difference between rated importance and level of development for all students by country.

Generic competence	France	Greece	Hungary	Poland	Slovak Republic
International Relations and Collaborations	1.1	0.63	0.39	0.81	0.58
Capacity to adapt to new situations	1.06	0.74	0.76	0.54	0.42
Ability to work in an interdisciplinary team	1.01	0.69	0.83	0.34	0.46
Ability to work in an international context	1	0.96	0.72	0.91	0.69
Capacity for generating new ideas (creativity)	0.95	0.88	0.91	0.72	0.71
Decision making	0.93	0.7	0.59	0.51	0.58
Leadership	0.89	0.59	0.85	0.58	0.77
Initiative and entrepreneurial spirit	0.86	0.79	0.58	0.67	0.62
Will to succeed	0.8	0.72	0.63	0.55	0.57
Critical and self-critical abilities	0.78	0.6	0.62	0.33	0.41
Concern for quality	0.78	0.78	0.52	0.5	0.55
Patents and Intellectual Property Rights	0.78	0.61	0.23	0.49	0.45
Ability to communicate with non-experts (in the field)	0.77	0.56	0.79	0.57	0.46
Understanding of cultures and customs of other countries	0.72	0.49	0.45	0.45	0.56
Knowledge of a second language	0.7	0.9	1.08	0.78	0.92
Planning and time management	0.68	0.65	0.56	0.53	0.63
Interpersonal skills	0.68	0.45	0.8	0.38	0.59
Appreciation of ethical issues	0.68	0.65	0.36	0.39	0.46
Information management skills	0.66	0.48	0.62	0.33	0.3
Oral and written communication in your native language	0.61	0.51	0.53	0.33	0.33
Appreciation of diversity and multiculturality	0.6	0.56	0.49	0.42	0.43
Project design and management	0.6	0.72	0.4	0.6	0.47
Problem solving	0.58	0.78	0.6	0.64	0.53
Ability to work autonomously	0.58	0.77	0.41	0.26	0.35
Capacity for analysis and synthesis	0.53	0.71	0.08	0.37	0.32
Basic general technical knowledge of the profession of your work area	0.48	0.64	0.05	0.28	0.2
Capacity for applying knowledge in practice	0.47	0.77	0.72	0.71	0.6
Teamworking	0.47	0.38	0.88	0.35	0.6
Grounding in basic knowledge of the profession of your work area	0.44	0.47	-0.21	0.26	0.19
Research skills	0.44	0.69	0.32	0.19	0.25
Capacity to learn	0.43	0.75	0.48	0.32	0.31
Elementary computing skills	0.39	0.36	0.15	0.16	0.31

Table 4.13 Student perception of the importance of the specific competences

Specific competence	N	Mean
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	2196	3.29
28. Ability to work in a group on a major project	2182	3.29
21. Ability to demonstrate practical engineering skills	2180	3.24
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	2246	3.2
8. Ability to apply a systems approach to engineering problems	2195	3.17
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	2188	3.15
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	2199	3.09
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	2241	3.06
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2180	3.05
23. Ability to demonstrate understanding of the use of technical literature and other information sources	2192	3.04
11. Ability to identify and manage cost drivers in designs and projects	2185	3.02
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2244	2.99
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	2188	2.99
14. Ability to manage the design process and evaluate outcomes	2184	2.97
27. Ability to work with technical uncertainty	2187	2.94
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2173	2.93
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2177	2.92
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2182	2.91
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2192	2.91
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	2178	2.91
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2224	2.85
26. Ability to demonstrate awareness of quality issues	2181	2.85
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2178	2.84
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2219	2.83
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2200	2.82
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2185	2.81
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2192	2.8
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2177	2.78

Table 4.14 Rank order of rated specific competences for all students and for Bachelor and Master level students.

Specific competence	All	Bachelor	Master
28. Ability to work in a group on a major project	1	2	1
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	2	1	4
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3	3	2
21. Ability to demonstrate practical engineering skills	4	5	3
8. Ability to apply a systems approach to engineering problems	5	4	6
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	6	7	7
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	7	6	8
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	8	9	5
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	9	8	9
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	10	10	11
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	11	11	10
11. Ability to identify and manage cost drivers in designs and projects	12	13	14
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	13	12	19
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	14	15	12
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	15	14	20
14. Ability to manage the design process and evaluate outcomes	16	16	13
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	17	17	17
23. Ability to demonstrate understanding of the use of technical literature and other information sources	18	18	16
27. Ability to work with technical uncertainty	19	19	25
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	20	21	15
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	21	22	26
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	22	24	21
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	23	23	24
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	24	20	27
26. Ability to demonstrate awareness of quality issues	25	25	23
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	26	26	22
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	27	27	18
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	28	28	28

Table 4.15 Student perception of the level of development of the specific competences

Specific competence	N	Mean
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2242	2.9
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	2195	2.89
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	2242	2.86
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	2198	2.72
8. Ability to apply a systems approach to engineering problems	2193	2.71
21. Ability to demonstrate practical engineering skills	2179	2.7
28. Ability to work in a group on a major project	2180	2.69
23. Ability to demonstrate understanding of the use of technical literature and other information sources	2190	2.67
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	2239	2.58
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2174	2.51
27. Ability to work with technical uncertainty	2185	2.51
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	2177	2.5
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	2186	2.49
26. Ability to demonstrate awareness of quality issues	2175	2.49
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	2186	2.48
14. Ability to manage the design process and evaluate outcomes	2180	2.46
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2176	2.46
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2179	2.45
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2216	2.44
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2181	2.42
11. Ability to identify and manage cost drivers in designs and projects	2183	2.38
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2176	2.38
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2189	2.36
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2222	2.33
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2174	2.33
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2190	2.32
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2197	2.29
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2184	2.25

Table 4.16 Student perception of the level of development of the specific competences by gender

Specific competence	Male	Female
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	2.85	2.91
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2.91	2.9
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	2.59	2.58
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.44	2.44
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	***2.31***	***2.5***
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	2.89	2.89
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	2.72	2.75
8. Ability to apply a systems approach to engineering problems	2.72	2.64
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	2.48	2.46
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	***2.48***	***2.59***
11. Ability to identify and manage cost drivers in designs and projects	2.37	2.46
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2.44	2.49
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2.43	2.39
14. Ability to manage the design process and evaluate outcomes	2.47	2.45
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.28	2.36
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.32	2.31
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.37	2.32
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.26	2.25
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.37	2.43
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	2.51	2.51
21. Ability to demonstrate practical engineering skills	2.71	2.71
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2.52	2.49
23. Ability to demonstrate understanding of the use of technical literature and other information sources	2.66	2.7
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.33	2.37
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.46	2.47
26. Ability to demonstrate awareness of quality issues	2.49	2.54
27. Ability to work with technical uncertainty	2.52	2.48
28. Ability to work in a group on a major project	***2.67***	***2.83***

Table 4.17 Comparison of mean difference between rated importance and level of development for all students by gender.

Specific competence	All	Male	Female
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.67	0.68	0.59
11. Ability to identify and manage cost drivers in designs and projects	0.64	0.65	0.6
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.61	0.61	0.59
28. Ability to work in a group on a major project	0.6	0.61	0.51
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.56	0.55	0.62
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	0.56	0.54	0.63
21. Ability to demonstrate practical engineering skills	0.54	0.54	0.49
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	0.53	0.53	0.53
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	0.52	0.52	0.52
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	0.51	0.5	0.61
14. Ability to manage the design process and evaluate outcomes	0.51	0.5	0.56
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	0.49	0.48	0.52
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	0.48	0.48	0.47
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	0.48	0.48	0.51
8. Ability to apply a systems approach to engineering problems	0.47	0.46	0.55
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	0.47	0.47	0.46
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.46	0.46	0.46
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	0.45	0.44	0.51
27. Ability to work with technical uncertainty	0.43	0.42	0.48
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	0.42	0.41	0.5
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.41	0.41	0.41
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	0.41	0.41	0.38
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	0.39	0.39	0.46
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.37	0.37	0.4
23. Ability to demonstrate understanding of the use of technical literature and other information sources	0.37	0.37	0.36
26. Ability to demonstrate awareness of quality issues	0.36	0.39	0.25
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.34	0.34	0.37
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	0.09	0.08	0.15

Table 4.19 Comparison of mean difference between rated importance and level of development of the specific competences for all students by level of study.

Specific competence	All	Bachelor	Master
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.67	0.66	0.7
11. Ability to identify and manage cost drivers in designs and projects	0.64	0.62	0.7
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.61	0.6	0.63
28. Ability to work in a group on a major project	0.6	0.6	0.59
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.56	0.56	0.56
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	**0.56**	**0.53**	**0.65**
21. Ability to demonstrate practical engineering skills	0.54	0.52	0.57
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	0.53	0.54	0.53
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	0.52	0.52	0.54
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	0.51	0.53	0.48
14. Ability to manage the design process and evaluate outcomes	0.51	0.5	0.54
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	0.49	0.47	0.53
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	0.48	0.49	0.47
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	0.48	0.47	0.55
8. Ability to apply a systems approach to engineering problems	0.47	0.47	0.47
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	**0.47**	**0.45**	**0.54**
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.46	0.47	0.47
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	0.45	0.45	0.44
27. Ability to work with technical uncertainty	0.43	0.42	0.44
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	0.42	0.41	0.42
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.41	0.41	0.4
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	0.41	0.42	0.38
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	0.39	0.41	0.35
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.37	0.38	0.33
23. Ability to demonstrate understanding of the use of technical literature and other information sources	0.37	0.38	0.35
26. Ability to demonstrate awareness of quality issues	0.36	0.39	0.34
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin	0.34	0.36	0.3

the engineering discipline			
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	**0.09**	**0.12**	**0.03**

Table 5.2 Mean of the importance of the generic competences for all academics

Generic competence	N	Mean
Elementary computing skills – Importance	185	3.6
Capacity for applying knowledge in practice – Importance	185	3.58
Problem solving – Importance	184	3.58
Capacity for analysis and synthesis – Importance	185	3.54
Basic general technical knowledge of the profession of your work area – Importance	184	3.53
Capacity to learn – Importance	185	3.52
Information management skills – Importance	185	3.46
Capacity to adapt to new situations – Importance	185	3.43
Teamworking – Importance	185	3.41
Ability to work autonomously – Importance	185	3.41
Concern for quality – Importance	185	3.39
Oral and written communication in your native language – Importance	185	3.36
Capacity for generating new ideas (creativity) – Importance	185	3.33
Grounding in basic knowledge of the profession of your work area – Importance	183	3.32
Project design and management – Importance	185	3.29
Knowledge of a second language – Importance	185	3.23
Ability to work in an interdisciplinary team – Importance	184	3.22
Decision making – Importance	185	3.21
Planning and time management – Importance	184	3.2
Will to succeed – Importance	182	3.17
Critical and self-critical abilities – Importance	184	3.12
Interpersonal skills – Importance	181	3.07
Initiative and entrepreneurial spirit – Importance	183	3.07
Ability to communicate with non-experts (in the field) – Importance	184	3.01
Ability to work in an international context – Importance	185	2.97
Research skills -Importance	185	2.86
Appreciation of ethical issues – Importance	185	2.83
Leadership – Importance	184	2.82
International Relations and Collaborations – Importance	182	2.79
Appreciation of diversity and multiculturality – Importance	184	2.66
Patents and Intellectual Property Rights – Importance	184	2.65
Understanding of cultures and customs of other countries – Importance	185	2.5

Table 5.2(a) Mean of the importance of the generic competences for all academics by country

Generic competence	France	Greece	Slovak Republic	Spain	Turkey	Total
Capacity for applying knowledge in practice – Importance	3.6	3.47	3.7	3.65	3.71	3.63
Problem solving – Importance	3.67	3.6	3.55	3.76	3.43	3.63
Basic general technical knowledge of the profession of your work area – Importance	3.87	3.27	3.7	3.65	3.57	3.62
Elementary computing skills – Importance	3.47	3.6	3.65	3.74	3.5	3.62
Capacity to learn – Importance	3.8	3.33	3.55	3.59	3.57	3.57
Capacity for analysis and synthesis – Importance	3.73	3.47	3.55	3.5	3.64	3.56
Information management skills – Importance	3.6	3.13	3.55	3.71	3.57	3.55
Capacity to adapt to new situations – Importance	3.73	3.4	3.45	3.53	3.21	3.48
Ability to work autonomously – Importance	3.6	3.4	3.4	3.5	3.5	3.48
Concern for quality – Importance	3.4	3.53	3.6	3.56	3.14	3.48
Teamworking – Importance	3.6	3.33	3.35	3.53	3.43	3.46
Grounding in basic knowledge of the profession of your work area – Importance	3.67	3.47	3.55	3.47	2.86	3.43
Oral and written communication in your native language – Importance	3.47	3.27	3.5	3.38	3.29	3.39
Knowledge of a second language – Importance	3.47	3.07	3.2	3.53	3.36	3.36
Capacity for generating new ideas (creativity) – Importance	3.53	3.33	3.3	3.44	3.07	3.36
Project design and management – Importance	3.4	3.13	3.2	3.38	3.21	3.29
Planning and time management – Importance	3.27	3.33	3.2	3.26	3.14	3.24
Ability to work in an interdisciplinary team – Importance	3.4	3.33	3.05	3.24	3.29	3.24
Decision making – Importance	3.33	3.13	3.05	3.32	3.21	3.22
Will to succeed – Importance	3.31	3.33	3.3	3.18	3	3.22
Critical and self-critical abilities – Importance	3.4	3	3.15	3.18	3	3.15
Interpersonal skills – Importance	2.82	3.13	3.3	3.15	3.14	3.14
Ability to work in an international context – Importance	3.27	2.8	3	3.09	3.07	3.05
Initiative and entrepreneurial spirit – Importance	3.07	2.87	3.2	3.15	2.71	3.04
Ability to communicate with non-experts (in the field) – Importance	2.87	3.07	2.9	3.18	3	3.03
Appreciation of ethical issues – Importance	2.47	3	3.25	3.03	2.5	2.91
Research skills -Importance	3	2.53	3.15	2.97	2.29	2.85
Leadership – Importance	2.93	2.93	2.85	2.74	2.93	2.85
International Relations and Collaborations – Importance	3.27	2.53	3	2.76	2.5	2.82
Appreciation of diversity and multiculturality – Importance	2.57	2.67	2.9	2.74	2.5	2.7
Patents and Intellectual Property Rights – Importance	2.67	2.8	3.1	2.62	2.29	2.7
Understanding of cultures and customs of other countries – Importance	2.73	2.4	2.85	2.65	2.21	2.6

Table 5.4 Mean importance of the generic competence comparing the Bachelor and Master levels

Generic competence	Bachelor	Master
Elementary computing skills – Importance	3.7	3.51
Capacity for applying knowledge in practice – Importance	3.6	3.6
Problem solving – Importance	3.58	3.57
Basic general technical knowledge of the profession of your work area – Importance	3.55	3.49
Capacity for analysis and synthesis – Importance	3.54	3.52
Capacity to learn – Importance	3.54	3.54
Ability to work autonomously – Importance	3.51	3.37
Capacity to adapt to new situations – Importance	3.48	3.4
Teamworking – Importance	3.48	3.34
Information management skills – Importance	3.45	3.48
Concern for quality – Importance	3.45	3.35
Oral and written communication in your native language – Importance	3.43	3.31
Capacity for generating new ideas (creativity) – Importance	3.41	3.18
Project design and management – Importance	3.38	3.15
Grounding in basic knowledge of the profession of your work area – Importance	3.34	3.35
Decision making – Importance	***3.3***	***3.05***
Will to succeed – Importance	3.29	3.06
Ability to work in an interdisciplinary team – Importance	3.26	3.15
Planning and time management – Importance	3.24	3.11
Critical and self-critical abilities – Importance	3.23	3.02
Interpersonal skills – Importance	***3.19***	***2.94***
Knowledge of a second language – Importance	3.15	3.31
Initiative and entrepreneurial spirit – Importance	3.12	3.02
Ability to communicate with non-experts (in the field) – Importance	3.09	2.89
Ability to work in an international context – Importance	3.02	2.86
Leadership – Importance	***2.96***	***2.61***
Appreciation of ethical issues – Importance	2.93	2.78
Research skills -Importance	2.85	2.85
Appreciation of diversity and multiculturality – Importance	***2.84***	***2.45***
International Relations and Collaborations – Importance	2.83	2.69
Patents and Intellectual Property Rights – Importance	2.67	2.62
Understanding of cultures and customs of other countries – Importance	***2.62***	***2.31***

Table 5.5 Mean level of development of the generic competences for all academics and by level of study

Generic competence	All	Bachelor	Master
Elementary computing skills – Level	3.39	3.48	3.37
Basic general technical knowledge of the profession of your work area – Level	***3.21***	***3.32***	***3.05***
Capacity for analysis and synthesis – Level	3.14	3.18	3.11
Grounding in basic knowledge of the profession of your work area – Level	3.08	3.16	3.03
Capacity for applying knowledge in practice – Level	3.06	3.11	3.06
Capacity to learn – Level	3.01	3.08	2.92
Problem solving – Level	2.99	2.97	3.05
Ability to work autonomously – Level	2.92	2.95	2.95
Information management skills – Level	2.86	2.89	2.86
Teamworking – Level	2.86	2.92	2.88
Project design and management – Level	2.81	2.88	2.75
Oral and written communication in your native language – Level	2.78	2.83	2.69
Capacity to adapt to new situations – Level	2.78	2.79	2.82
Concern for quality – Level	2.76	2.77	2.75
Capacity for generating new ideas (creativity) – Level	2.7	2.79	2.58
Will to succeed – Level	***2.7***	***2.84***	***2.52***
Decision making – Level	2.66	2.7	2.62
Interpersonal skills – Level	2.63	2.77	2.53
Critical and self-critical abilities – Level	2.56	2.63	2.43
Planning and time management – Level	2.55	2.57	2.49
Research skills – Level	2.51	2.57	2.48
Ability to work in an interdisciplinary team – Level	2.51	2.6	2.43
Knowledge of a second language – Level	2.49	2.45	2.63
Ability to work in an international context – Level	2.45	2.51	2.45
Initiative and entrepreneurial spirit – Level	2.4	2.43	2.37
Ability to communicate with non-experts (in the field) – Level	2.36	2.43	2.32
Appreciation of diversity and multiculturality – Level	2.36	2.46	2.31
Appreciation of ethical issues – Level	2.36	2.45	2.32
International Relations and Collaborations – Level	2.33	2.41	2.23
Leadership – Level	***2.31***	***2.48***	***2.13***
Understanding of cultures and customs of other countries – Level	2.15	2.24	2.08
Patents and Intellectual Property Rights – Level	2.09	2.12	2.08

Table 5.5(a) Mean level of development of the generic competences for all academics and by country

Generic competence	France	Greece	Slovak Republic	Spain	Turkey	Total
Elementary computing skills – Level	3.2	3.27	3.7	3.56	3.5	3.48
Basic general technical knowledge of the profession of your work area – Level	3.33	3.27	3.45	3.21	3.29	3.3
Capacity for analysis and synthesis – Level	3.33	3.33	3.45	3.06	3.43	3.28
Grounding in basic knowledge of the profession of your work area – Level	3.27	3.27	3.45	3.09	2.79	3.17
Capacity to learn – Level	3.07	3.33	3.25	2.97	3.14	3.12
Problem solving – Level	3.27	3.13	3.25	2.97	3.14	3.12
Capacity for applying knowledge in practice – Level	3.4	3.2	3.35	2.82	3.07	3.11
Ability to work autonomously – Level	3.07	3.07	3.2	2.94	3.07	3.05
Teamworking – Level	3.27	3.07	3.05	2.79	2.71	2.95
Information management skills – Level	2.87	2.67	3.15	2.97	2.86	2.93
Concern for quality – Level	2.8	3	3.1	2.88	2.71	2.91
Capacity to adapt to new situations – Level	2.93	3	3.05	2.79	2.5	2.86
Project design and management – Level	3	2.8	2.9	2.76	2.86	2.85
Will to succeed – Level	2.46	3	3.15	2.76	2.64	2.82
Oral and written communication in your native language – Level	2.6	2.8	3.32	2.74	2.57	2.81
Capacity for generating new ideas (creativity) – Level	2.6	2.8	2.95	2.62	2.64	2.71
Interpersonal skills – Level	2.09	2.73	3.15	2.68	2.57	2.7
Decision making – Level	2.67	2.6	2.95	2.59	2.57	2.67
Critical and self-critical abilities – Level	2.6	2.8	2.95	2.44	2.64	2.65
Knowledge of a second language – Level	2.6	2.6	2.9	2.65	2.29	2.63
Planning and time management – Level	2.53	2.73	2.8	2.59	2.36	2.61
Ability to work in an international context – Level	2.8	2.73	2.75	2.47	2.36	2.6
Research skills – Level	2.67	2.53	2.85	2.59	2.07	2.57
Ability to work in an interdisciplinary team – Level	2.6	3	2.65	2.35	2.5	2.57
Appreciation of ethical issues – Level	2.07	2.8	2.9	2.59	2.21	2.55
Appreciation of diversity and multiculturality – Level	2.43	2.67	2.8	2.35	2.5	2.53
Initiative and entrepreneurial spirit – Level	2.4	2.4	2.8	2.41	2.36	2.48
Ability to communicate with non-experts (in the field) – Level	2.2	2.8	2.55	2.41	2.36	2.46
International Relations and Collaborations – Level	2.6	2.53	2.6	2.26	2.21	2.42
Leadership – Level	2.14	2.6	2.5	2.26	2.21	2.34
Understanding of cultures and customs of other countries – Level	2.13	2.4	2.65	2.32	2	2.33
Patents and Intellectual Property Rights – Level	2	2.33	2.6	1.85	1.79	2.09

Table 5.6 Mean gap between rated importance and level of development of the generic competences for all academics and by level of study

Generic competence	All	Bachelor	Master
Knowledge of a second language	0.74	0.71	0.68
Ability to work in an interdisciplinary team	0.7	0.66	0.72
Initiative and entrepreneurial spirit	0.67	0.69	0.65
Planning and time management	0.65	0.67	0.62
Capacity to adapt to new situations	0.65	0.68	0.58
Ability to communicate with non-experts (in the field)	0.65	0.66	0.57
Capacity for generating new ideas (creativity)	0.63	0.62	0.6
Concern for quality	0.63	0.67	0.6
Information management skills	0.6	0.55	0.62
Oral and written communication in your native language	0.58	0.61	0.62
Problem solving	0.58	0.62	0.52
Critical and self-critical abilities	0.57	0.59	0.58
Decision making	0.55	0.61	0.43
Teamworking	0.55	0.55	0.46
Patents and Intellectual Property Rights	0.55	0.55	0.54
Capacity for applying knowledge in practice	0.53	0.51	0.54
Capacity to learn	0.52	0.47	0.62
Leadership	0.51	0.47	0.48
Ability to work in an international context	0.51	0.51	0.42
Ability to work autonomously	0.49	0.57	0.42
Project design and management	0.48	0.5	0.4
Appreciation of ethical issues	0.47	0.49	0.46
Will to succeed	0.47	0.45	0.54
International Relations and Collaborations	0.46	0.43	0.46
Interpersonal skills	0.44	0.43	0.4
Capacity for analysis and synthesis	0.41	0.37	0.42
Research skills	0.36	0.28	0.37
Understanding of cultures and customs of other countries	0.35	0.38	0.23
Basic general technical knowledge of the profession of your work area	0.32	0.22	0.45
Appreciation of diversity and multiculturality	0.3	0.38	0.14
Grounding in basic knowledge of the profession of your work area	0.24	0.19	0.32
Elementary computing skills	0.21	0.22	0.14

Table 5.7 Mean 'gap' in generic competences by country

Generic competence	Bulgaria	France	Greece	Ireland	Poland	Slovak Republic	Spain	Turkey	United Kingdom
Ability to communicate with non-experts (in the field)	0.8	0.67	0.27	1	0.64	0.35	0.76	0.64	0.88
Ability to work autonomously	0.5	0.53	0.33	0.83	0.73	0.2	0.56	0.43	0.4
Ability to work in an interdisciplinary team	1.2	0.8	0.33	0.75	0.91	0.4	0.88	0.79	0.63
Ability to work in an international context	0.6	0.47	0.07	0.83	0.36	0.25	0.62	0.71	0.7
Appreciation of diversity and multiculturality	0	0.14	0	0.42	0.45	0.1	0.38	0	0.9
Appreciation of ethical issues	0.7	0.4	0.2	0.42	0.82	0.35	0.44	0.29	0.7
Basic general technical knowledge of the profession of your work area	0.3	0.53	0	0.42	0.45	0.25	0.44	0.29	0.25
Capacity for analysis and synthesis	0.9	0.4	0.13	0.58	0.55	0.1	0.44	0.21	0.22
Capacity for applying knowledge in practice	0.6	0.2	0.27	0.58	0.64	0.35	0.82	0.64	1
Capacity for generating new ideas (creativity)	0.5	0.93	0.53	0.92	0.73	0.35	0.82	0.43	0.7
Capacity to adapt to new situations	0.6	0.8	0.4	1.25	0.55	0.4	0.74	0.71	0.5
Capacity to learn	0.4	0.73	0	0.67	0.73	0.3	0.62	0.43	1.1
Concern for quality	0.7	0.6	0.53	0.5	0.91	0.5	0.68	0.43	0.7
Critical and self-critical abilities	0.5	0.8	0.2	1.08	0.55	0.2	0.74	0.36	0.8
Decision making	0.6	0.67	0.53	0.58	0.45	0.1	0.74	0.64	1
Elementary computing skills	0.6	0.27	0.33	0.25	0.18	-0.05	0.18	0	0.4
Grounding in basic knowledge of the profession of your work area	0.3	0.4	0.2	0.17	0.36	0.1	0.38	0.07	0.44
Information management skills	0.5	0.73	0.47	0.75	0.82	0.4	0.74	0.71	0.4
Initiative and entrepreneurial spirit	1.1	0.67	0.47	0.75	0.73	0.4	0.74	0.36	0.6
International Relations and Collaborations	0.5	0.67	0	0.67	0.73	0.4	0.5	0.29	0.89
Interpersonal skills	0.8	0.73	0.4	0.08	0.55	0.15	0.47	0.57	0.78
Knowledge of a second language	1.1	0.87	0.47	0.67	0.91	0.3	0.88	1.07	0.9
Leadership	1	0.79	0.33	0.25	0.64	0.35	0.47	0.71	0.67
Oral and written communication in your native language	1	0.87	0.47	0.58	0.55	0.16	0.65	0.71	1.1
Patents and Intellectual Property Rights	0.6	0.67	0.47	0.33	0.73	0.5	0.76	0.5	0.7
Planning and time management	1.3	0.73	0.6	0.75	0.64	0.4	0.68	0.79	0.6
Problem solving	0.8	0.4	0.47	1	0.64	0.3	0.79	0.29	0.8
Project design and management	0.7	0.4	0.33	0.58	0.64	0.3	0.62	0.36	0.4
Research skills	0.7	0.33	0	0.67	0.36	0.3	0.38	0.21	0.3
Teamworking	0.4	0.33	0.27	0.67	0.82	0.3	0.74	0.71	0.3
Understanding of cultures and customs of other countries	0.5	0.6	0	0.67	0.27	0.2	0.32	0.21	1
Will to succeed	0.5	0.85	0.33	0.42	0.73	0.15	0.41	0.36	0.78

Table 5.9 Academic perception of the importance of the specific competences

Specific competence	All	Bachelor	Master
21. Ability to demonstrate practical engineering skills	3.57	3.63	3.55
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.45	3.48	3.43
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.45	3.43	3.49
8. Ability to apply a systems approach to engineering problems	3.43	3.42	3.52
28. Ability to work in a group on a major project	3.4	3.48	3.4
23. Ability to demonstrate understanding of the use of technical literature and other information sources	3.34	3.33	3.37
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	3.33	3.38	3.3
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	3.25	3.24	3.29
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	3.22	3.3	3.17
26. Ability to demonstrate awareness of quality issues	3.22	3.33	3.28
14. Ability to manage the design process and evaluate outcomes	3.18	3.24	3.25
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	3.16	3.19	3.12
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	3.12	3.1	3.18
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	3.11	3.14	3.11
11. Ability to identify and manage cost drivers in designs and projects	3.11	3.15	3.12
27. Ability to work with technical uncertainty	3.09	3.11	3.12
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	3.04	3.11	3.05
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	3.04	3.05	3.05
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	3.02	3.11	3.09
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.99	3.03	3.03
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.98	3.07	2.98
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.96	3.1	2.88
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.95	3.04	2.91
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.94	3.07	2.85
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.93	2.97	2.91
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.82	2.78	2.83
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.79	2.9	2.68
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.78	2.84	2.74

Table 5.9(a) Academic perception of the importance of the specific competences by country

Specific competence	France	Greece	Slovak Republic	Spain	Turkey	Total
21. Ability to demonstrate practical engineering skills	3.67	3.53	3.45	3.5	3.43	3.51
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.53	3.67	3.45	3.44	3.36	3.48
8. Ability to apply a systems approach to engineering problems	3.73	3.4	3.2	3.5	3.5	3.46
28. Ability to work in a group on a major project	3.53	3.67	3.35	3.35	3.36	3.43
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.47	3.27	3.35	3.41	3.43	3.39
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	3.64	3.47	3.15	3.29	3.57	3.38
23. Ability to demonstrate understanding of the use of technical literature and other information sources	3.53	3.53	3.2	3.18	3.29	3.31
26. Ability to demonstrate awareness of quality issues	3.53	3.67	3.05	3.26	3.07	3.3
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	3.4	3.4	3.2	3.24	3.21	3.28
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	3.4	3.33	3.05	3.24	3.14	3.22
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	3.07	3.33	3.1	3.35	2.86	3.18
14. Ability to manage the design process and evaluate outcomes	3.33	3.33	3.05	3.09	3.07	3.15
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	3.4	3.2	3	3.09	3.21	3.15
27. Ability to work with technical uncertainty	3.33	3.2	2.9	3.21	3	3.13
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	3.33	3.47	2.8	3.03	3.21	3.12
11. Ability to identify and manage cost drivers in designs and projects	3.2	3.47	2.75	3.12	3.21	3.12
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	3.07	3.27	2.7	3.12	3.29	3.07
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	3.27	3.4	2.85	2.85	3.29	3.06
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	3.2	3.13	2.89	3.09	2.93	3.05
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	3	3.4	2.75	2.94	2.86	2.97
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	3.33	3.4	2.7	2.88	2.71	2.97
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	3.43	2.87	2.55	3	3.07	2.96
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	3.13	3.4	2.65	2.82	2.86	2.93
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.73	3.4	2.65	2.91	3	2.92

19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	3	3.4	2.75	2.82	2.64	2.9
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	3	3	2.85	2.91	2.57	2.88
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.8	3.27	2.65	2.68	2.86	2.81
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.6	3.4	2.55	2.65	2.71	2.74

Table 5.10 Academic perception of the level of development of the specific competences for all and by level of study

Specific competences	All	Bachelor	Master
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.14	3.22	3.08
21. Ability to demonstrate practical engineering skills	3.09	3.19	3
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.08	3.16	3.02
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	2.95	3.04	2.88
23. Ability to demonstrate understanding of the use of technical literature and other information sources	2.92	2.97	2.91
28. Ability to work in a group on a major project	2.89	2.99	2.85
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	***2.84***	***2.97***	***2.65***
8. Ability to apply a systems approach to engineering problems	2.83	2.91	2.75
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	2.8	2.84	2.83
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	2.7	2.84	2.6
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2.65	2.74	2.62
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2.61	2.65	2.55
26. Ability to demonstrate awareness of quality issues	2.61	2.76	2.62
27. Ability to work with technical uncertainty	2.6	2.67	2.6
14. Ability to manage the design process and evaluate outcomes	2.59	2.71	2.58
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	***2.49***	***2.64***	***2.37***
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	2.48	2.51	2.51
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.44	2.56	2.34
11. Ability to identify and manage cost drivers in designs and projects	2.43	2.52	2.45
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2.43	2.55	2.38
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.43	2.48	2.4
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	***2.4***	***2.55***	***2.26***
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.36	2.4	2.38
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.35	2.47	2.31
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.34	2.31	2.35
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.34	2.44	2.33
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.18	2.31	2.11
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.17	2.2	2.2

Table 5.10(a) Academic perception of the level of development of the specific competences for all and by country

Specific competence	France	Greece	Slovak Republic	Spain	Turkey	Total
21. Ability to demonstrate practical engineering skills	3.4	3	3.1	3.18	3.36	3.19
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.2	3.13	3.05	3.21	3.36	3.18
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.13	3.2	3	3.24	3.36	3.18
23. Ability to demonstrate understanding of the use of technical literature and other information sources	2.87	2.93	2.9	3.18	3.07	3.02
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2.67	3.2	2.8	3.21	3	3.01
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	3.14	3	2.7	3.09	3.07	3
8. Ability to apply a systems approach to engineering problems	3.07	2.93	2.7	3.12	2.86	2.96
28. Ability to work in a group on a major project	3	2.93	2.95	2.91	2.86	2.93
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	3	3	2.75	2.97	2.64	2.89
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	2.67	2.87	2.7	2.85	2.79	2.79
26. Ability to demonstrate awareness of quality issues	2.8	3	2.45	2.85	2.5	2.73
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2.67	2.87	2.6	2.71	2.64	2.69
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2.8	2.53	2.58	2.79	2.57	2.68
27. Ability to work with technical uncertainty	2.47	2.67	2.6	2.79	2.57	2.65
14. Ability to manage the design process and evaluate outcomes	2.67	2.8	2.65	2.62	2.5	2.64
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	2.6	2.73	2.35	2.53	2.43	2.52
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	2.4	2.73	2.35	2.56	2.29	2.48
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.47	2.67	2.4	2.53	2.29	2.48
11. Ability to identify and manage cost drivers in designs and projects	2.53	2.4	2.3	2.56	2.5	2.47
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.43	2.47	2.1	2.62	2.57	2.45
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2.53	2.6	2.2	2.47	2.5	2.45

15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.13	2.8	2.35	2.41	2.36	2.41
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.4	2.6	2.2	2.5	2.29	2.41
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.4	2.6	2.3	2.44	2.29	2.41
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.07	2.07	2.5	2.65	2.07	2.36
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.27	2.73	2.15	2.53	1.93	2.36
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2	2.47	2.2	2.35	1.86	2.21
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	1.87	2.4	2.1	2.35	1.86	2.16

Table 5.11 Comparison of mean difference between rated importance and level of development of the specific competences for all academics and by level of study.

Specific competence	All	Bachelor	Master
Ability to identify and manage cost drivers in designs and projects	0.68	0.64	0.68
Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	0.64	0.64	0.6
Ability to demonstrate understanding of appropriate codes of practice and industry standards	0.62	0.67	0.61
Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	0.61	0.59	0.57
Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.61	0.63	0.57
Ability to demonstrate awareness of quality issues	0.61	0.57	0.66
Ability to apply a systems approach to engineering problems	***0.6***	***0.51***	***0.77***
Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.6	0.5	0.68
Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.6	0.6	0.58
Ability to demonstrate awareness of the nature of intellectual property and contractual issues	0.6	0.64	0.54
Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	0.59	0.56	0.72
Ability to manage the design process and evaluate outcomes	0.59	0.53	0.66
Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.56	0.47	0.68
Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	0.55	0.47	0.69
Ability to demonstrate knowledge and understanding of the commercial and economic context	0.54	0.52	0.58
Ability to apply and integrate knowledge and understanding of other engineering disciplines	0.52	0.46	0.57
Ability to work in a group on a major project	0.51	0.49	0.55
Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	0.49	0.48	0.51
Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	0.48	0.47	0.48
Ability to work with technical uncertainty	0.48	0.44	0.52
Ability to demonstrate practical engineering skills	0.47	0.44	0.55
Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	0.43	0.41	0.49
Ability to demonstrate understanding of the use of technical literature and other information sources	0.41	0.36	0.46
Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.38	0.34	0.42
Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.36	0.32	0.42
Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	0.32	0.22	0.48
Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.32	0.21	0.42
Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	0.32	0.26	0.35

Table 5.12 Mean 'gap' in specific competences by country

	Bulgaria	France	Greece	Ireland	Poland	Slovak Republic	Spain	Turkey	United Kingdom
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.6	0.33	0.53	0.58	0.64	0.4	0.24	0	0.44
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	0.9	0.4	0.13	0.67	0.45	0.3	0.15	-0.14	0.22
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	0.7	0.73	0.53	0.92	0.55	0.5	0.38	0.43	0.56
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	0.8	1	0.4	0.75	0.82	0.45	0.38	0.5	0.5
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	0.4	0.93	0.93	0.42	0.82	0.35	0.26	0.5	0.89
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.6	0.33	0.07	0.58	0.55	0.35	0.18	0.07	0.22
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.7	0.5	0.47	0.75	0.36	0.45	0.21	0.5	0
8. Ability to apply a systems approach to engineering problems	0.6	0.67	0.47	0.5	1.18	0.5	0.38	0.64	0.78
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	0.8	0.73	0.73	0.75	1	0.45	0.5	0.79	0.56
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.7	0.67	0.53	0.42	0.91	0.35	0.56	1	0.62
11. Ability to identify and manage cost drivers in designs and projects	0.6	0.67	1.07	0.75	0.82	0.45	0.56	0.71	0.44
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.8	0.73	0.47	0.75	1.09	0.45	0.53	0.5	0.25
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	0.8	0.47	0.8	0.42	0.73	0.55	0.47	0.36	0.89
14. Ability to manage the design process and evaluate outcomes	0.5	0.67	0.53	0.67	0.73	0.4	0.47	0.57	0.56
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	0.4	0.6	0.6	0.67	0.73	0.3	0.5	0.64	0.89

16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	0.3	0.87	0.73	0.58	0.64	0.3	0.35	0.43	0.78
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.5	0.73	0.8	0.5	1	0.45	0.32	0.57	1.11
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	0.6	0.73	1	0.67	0.91	0.45	0.29	0.86	0.78
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.7	0.73	0.67	0.83	0.64	0.6	0.29	0.71	1
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	0.3	0.4	0.2	0.17	0.45	0.25	0.12	0.57	0.44
21. Ability to demonstrate practical engineering skills	0.6	0.27	0.53	0.5	1.09	0.35	0.32	0.07	0.33
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	0.5	0.4	0.6	0.33	0.64	0.32	0.29	0.36	0.33
23. Ability to demonstrate understanding of the use of technical literature and other information sources	0.4	0.67	0.6	0.58	1.09	0.3	0	0.21	0
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	0.6	0.8	0.8	0.5	0.64	0.45	0.32	1	0.89
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	0.5	0.87	0.8	0.42	0.73	0.55	0.41	1	0.67
26. Ability to demonstrate awareness of quality issues	0.2	0.73	0.67	0.67	0.91	0.6	0.41	0.57	0.78
27. Ability to work with technical uncertainty	0.4	0.87	0.53	0.5	0.55	0.3	0.41	0.43	0.56
28. Ability to work in a group on a major project	0.6	0.53	0.73	0.58	1.09	0.4	0.44	0.5	0.11

Table 6.1 Mean of importance of the generic competences for all employers and by level of study

Generic competences	All	Bachelor	Masters
Problem solving – Importance	3.62	3.54	3.73
Concern for quality – Importance	3.61	3.51	3.73
Capacity to learn – Importance	3.6	3.54	3.63
Teamworking – Importance	***3.6***	***3.46***	***3.76***
Capacity for applying knowledge in practice – Importance	3.59	3.46	3.71
Elementary computing skills – Importance	3.55	3.71	3.44
Oral and written communication in your native language – Importance	3.49	3.46	3.51
Capacity to adapt to new situations – Importance	***3.44***	***3.27***	***3.63***
Capacity for analysis and synthesis – Importance	3.4	3.39	3.46
Basic general technical knowledge of the profession of your work area – Importance	3.4	3.37	3.49
Information management skills – Importance	3.4	3.39	3.41
Ability to work autonomously – Importance	3.4	3.29	3.46
Capacity for generating new ideas (creativity) – Importance	3.36	3.44	3.27
Will to succeed – Importance	3.36	3.34	3.39
Decision making – Importance	3.26	3.22	3.32
Planning and time management – Importance	3.24	3.15	3.32
Interpersonal skills – Importance	3.24	3.17	3.34
Grounding in basic knowledge of the profession of your work area – Importance	3.21	3.24	3.17
Initiative and entrepreneurial spirit – Importance	3.2	3.22	3.17
Ability to communicate with non-experts (in the field) – Importance	3.16	3.15	3.22
Project design and management – Importance	3.12	3.02	3.17
Ability to work in an interdisciplinary team – Importance	3.06	2.93	3.2
Appreciation of ethical issues – Importance	3.02	2.98	3.07
Critical and self-critical abilities – Importance	2.98	2.85	3.1
Ability to work in an international context – Importance	2.95	2.78	3.12
Knowledge of a second language – Importance	***2.91***	***2.56***	***3.2***
Research skills -Importance	2.87	2.9	2.8
Appreciation of diversity and multiculturality – Importance	***2.78***	***2.51***	***3.05***
Leadership – Importance	2.72	2.59	2.8
International Relations and Collaborations – Importance	***2.68***	***2.46***	***2.88***
Patents and Intellectual Property Rights – Importance	2.61	2.49	2.73
Understanding of cultures and customs of other countries – Importance	2.51	2.44	2.56

Table 6.1(a) Mean of importance of the generic competences for all employers and by country

Generic competence	Bulgaria	France	Germany	Ireland	Poland	Total
Problem solving – Importance	3.8	3.71	3.4	3.78	3.31	3.63
Elementary computing skills – Importance	3.85	3.71	3.5	3.78	2.92	3.59
Capacity to learn – Importance	3.7	3.71	3.2	3.67	3.54	3.59
Concern for quality – Importance	3.75	2.86	3.6	3.78	3.46	3.59
Teamworking – Importance	3.7	4	3	3.56	3.46	3.54
Capacity for applying knowledge in practice – Importance	3.75	3.14	3.3	3.72	3.31	3.53
Oral and written communication in your native language – Importance	3.6	3.43	3.3	3.72	3.08	3.47
Capacity to adapt to new situations – Importance	3.6	3.43	2.9	3.44	3.46	3.41
Capacity for generating new ideas (creativity) – Importance	3.55	3.57	3.3	3.56	3	3.41
Information management skills – Importance	3.5	3.71	3.2	3.67	2.85	3.4
Capacity for analysis and synthesis – Importance	3.4	3.29	3	3.72	3.23	3.38
Basic general technical knowledge of the profession of your work area – Importance	3.65	3.14	3.4	3.33	3.08	3.37
Ability to work autonomously – Importance	3.4	3	3.3	3.56	3.23	3.35
Will to succeed – Importance	3.3	3.29	3.5	3.44	3.08	3.32
Decision making – Importance	3.55	3.29	3.1	3.39	2.85	3.28
Interpersonal skills – Importance	3.35	3	3	3.5	3	3.24
Initiative and entrepreneurial spirit – Importance	3.35	3.14	3.3	3.28	3	3.24
Planning and time management – Importance	3.25	3	3.1	3.33	3.08	3.19
Grounding in basic knowledge of the profession of your work area – Importance	3.2	3.29	3.2	3.28	3	3.19
Project design and management – Importance	2.9	3.43	3	3.33	3	3.1
Ability to communicate with non-experts (in the field) – Importance	3.2	3.43	2.8	3.28	2.69	3.09
Appreciation of ethical issues – Importance	3.25	2.57	3	3.06	2.77	3
Critical and self-critical abilities – Importance	2.95	3.14	2.9	3	2.85	2.96
Ability to work in an interdisciplinary team – Importance	3.05	3	2.8	3.11	2.62	2.94
Research skills -Importance	3	2.86	2.9	2.78	2.69	2.85
Ability to work in an international context – Importance	3.15	3.14	2.5	2.5	2.85	2.82
Knowledge of a second language – Importance	3.3	3.29	2	2	3.23	2.75
Leadership – Importance	3	2.86	2.3	2.78	2.38	2.71
Appreciation of diversity and multiculturality – Importance	3	2.43	2.3	2.5	2.62	2.63
Patents and Intellectual Property Rights – Importance	2.75	2.29	2.8	2.67	2	2.54
International Relations and Collaborations – Importance	2.85	2.43	2.6	2.28	2.46	2.54
Understanding of cultures and customs of other countries – Importance	2.35	2.57	2.3	2.28	2.38	2.35

Table 6.2 Weighted ranking of importance of generic competences by employers for all and by study level

Generic competence	All	Bachelor	Masters
Capacity for applying knowledge in practice – Importance	142	52	87
Capacity for analysis and synthesis – Importance	110	50	60
Capacity to learn – Importance	79	44	30
Teamworking – Importance	77	20	54
Basic general technical knowledge of the profession of your work area – Importance	71	36	34
Problem solving – Importance	67	38	24
Concern for quality – Importance	66	35	31
Research skills -Importance	61	42	19
Planning and time management – Importance	60	27	22
Ability to work autonomously – Importance	53	35	11
Decision making – Importance	52	19	33
Information management skills – Importance	51	29	20
Capacity for generating new ideas (creativity) – Importance	48	31	16
Grounding in basic knowledge of the profession of your work area – Importance	42	20	22
Knowledge of a second language – Importance	37	12	25
Elementary computing skills – Importance	27	16	11
Project design and management – Importance	24	16	6
Capacity to adapt to new situations – Importance	22	4	18
Interpersonal skills – Importance	18	11	7
Ability to communicate with non-experts (in the field) – Importance	17	6	11
Oral and written communication in your native language – Importance	16	3	13
Initiative and entrepreneurial spirit – Importance	14	9	0
Ability to work in an interdisciplinary team – Importance	12	10	2
International Relations and Collaborations – Importance	12	2	10
Ability to work in an international context – Importance	10	8	2
Appreciation of diversity and multiculturality – Importance	8	8	0
Critical and self-critical abilities – Importance	7	1	6
Will to succeed – Importance	7	5	2
Leadership – Importance	6	6	0
Appreciation of ethical issues – Importance	6	5	1
Patents and Intellectual Property Rights – Importance	4	0	4
Understanding of cultures and customs of other countries – Importance	0	0	0

Table 6.3 Employer view of mean level of development for the generic competences by academic level

Generic competence	All	Bachelor	Master
Elementary computing skills – Level	3.46	3.61	3.34
Capacity to learn – Level	3.19	3.17	3.2
Oral and written communication in your native language – Level	3.13	3.1	3.15
Will to succeed – Level	3	3.02	2.98
Basic general technical knowledge of the profession of your work area – Level	2.99	3.1	2.95
Grounding in basic knowledge of the profession of your work area – Level	2.95	3.2	2.73
Capacity for analysis and synthesis – Level	2.93	3.07	2.8
Information management skills – Level	2.92	2.95	2.88
Problem solving – Level	2.91	2.9	2.95
Teamworking – Level	2.88	2.71	3.05
Capacity for applying knowledge in practice – Level	2.85	2.93	2.8
Concern for quality – Level	2.82	2.85	2.76
Capacity to adapt to new situations – Level	2.79	2.8	2.78
Capacity for generating new ideas (creativity) – Level	2.76	2.8	2.73
Interpersonal skills – Level	2.74	2.76	2.76
Ability to work autonomously – Level	2.74	2.76	2.71
Decision making – Level	2.66	2.63	2.63
Project design and management – Level	2.64	2.63	2.61
Appreciation of ethical issues – Level	2.64	2.68	2.56
Ability to communicate with non-experts (in the field) – Level	2.6	2.68	2.51
Initiative and entrepreneurial spirit – Level	2.58	2.66	2.46
Research skills – Level	2.54	2.49	2.56
Ability to work in an interdisciplinary team – Level	2.52	2.54	2.49
Appreciation of diversity and multiculturality – Level	2.52	2.41	2.59
Ability to work in an international context – Level	2.52	2.41	2.56
Knowledge of a second language – Level	2.51	2.39	2.59
Critical and self-critical abilities – Level	2.51	2.44	2.54
Planning and time management – Level	2.48	2.59	2.39
Understanding of cultures and customs of other countries – Level	2.36	2.29	2.39
Leadership – Level	2.26	2.29	2.17
International Relations and Collaborations – Level	2.26	2.12	2.34
Patents and Intellectual Property Rights – Level	2.18	2.05	2.27

Table 6.3(a) Employer view of mean level of development for the generic competences by country

Generic competence	Bulgaria	France	Germany	Ireland	Poland	Total
Elementary computing skills – Level	3.65	3.57	3.6	3.83	2.69	3.5
Capacity to learn – Level	3.25	3.43	2.9	3.44	2.92	3.21
Oral and written communication in your native language – Level	3.5	3.43	3.1	3.06	2.69	3.16
Basic general technical knowledge of the profession of your work area – Level	3.35	3.14	3.3	3.11	2.15	3.03
Grounding in basic knowledge of the profession of your work area – Level	3.2	3	3.2	3.33	2.23	3.03
Capacity for analysis and synthesis – Level	2.95	3	3.1	3.39	2.31	2.97
Information management skills – Level	3.1	3	3	3.33	2.08	2.94
Will to succeed – Level	3.05	2.57	3.3	3.28	2.23	2.94
Problem solving – Level	3.15	3	3.2	3	2.15	2.91
Capacity for applying knowledge in practice – Level	3	2.71	2.9	3.22	2.31	2.88
Teamworking – Level	3.2	3.14	2.7	2.61	2.77	2.88
Concern for quality – Level	3.05	2.71	2.9	2.94	2.31	2.82
Capacity for generating new ideas (creativity) – Level	2.85	3.14	2.7	3.06	2.31	2.81
Capacity to adapt to new situations – Level	2.9	2.57	2.7	3.11	2.31	2.78
Ability to work autonomously – Level	2.9	2.71	2.8	3.11	2.08	2.76
Interpersonal skills – Level	2.9	2.86	2.8	2.94	2.08	2.74
Decision making – Level	2.8	3	2.6	2.78	2.15	2.66
Appreciation of ethical issues – Level	2.9	2.71	2.4	2.61	2.54	2.66
Project design and management – Level	2.75	2.86	2.7	2.67	2.23	2.63
Ability to communicate with non-experts (in the field) – Level	2.9	2.86	2.4	2.72	2	2.6
Initiative and entrepreneurial spirit – Level	2.65	2.43	2.7	2.83	2.23	2.6
Research skills – Level	2.45	2.71	2.9	2.39	2.46	2.53
Ability to work in an interdisciplinary team – Level	2.6	3.14	2.3	2.5	2.31	2.53
Critical and self-critical abilities – Level	2.6	2.43	2.5	2.61	2.23	2.5
Planning and time management – Level	2.65	2.71	2.2	2.89	1.77	2.49
Appreciation of diversity and multiculturality – Level	2.95	2.57	1.8	2.44	2.31	2.49
Knowledge of a second language – Level	2.6	3	2.1	2.39	2.23	2.44
Ability to work in an international context – Level	2.8	2.71	2	2.28	2.31	2.44
Understanding of cultures and customs of other countries – Level	2.4	2.57	1.9	2.22	2.38	2.29
Leadership – Level	2.25	2.86	2.2	2.39	1.77	2.25
Patents and Intellectual Property Rights – Level	2.5	2	2	2.06	1.92	2.15
International Relations and Collaborations – Level	2.45	2.43	2	1.83	1.92	2.12

Table 6.4 Comparison of mean difference between rated importance and level of development of the generic competences for all employers and by academic level.

Generic competence	All	Bachelor	Master
Concern for quality	0.79	0.66	0.98
Planning and time management	0.75	0.56	0.93
Capacity for applying knowledge in practice	0.74	0.54	0.9
Problem solving	0.72	0.63	0.78
Teamworking	0.72	0.76	0.71
Ability to work autonomously	0.66	0.54	0.76
Capacity to adapt to new situations	0.65	0.46	0.85
Initiative and entrepreneurial spirit	0.62	0.56	0.71
Capacity for generating new ideas (creativity)	0.6	0.63	0.54
Decision making	0.6	0.59	0.68
Ability to communicate with non-experts (in the field)	0.56	0.46	0.71
Ability to work in an interdisciplinary team	0.54	0.39	0.71
Interpersonal skills	0.49	0.41	0.59
Information management skills	0.48	0.44	0.54
Project design and management	0.48	0.39	0.56
Capacity for analysis and synthesis	0.47	0.32	0.66
Critical and self-critical abilities	0.47	0.41	0.56
Leadership	0.46	0.29	0.63
Ability to work in an international context	0.44	0.37	0.56
Patents and Intellectual Property Rights	0.44	0.44	0.46
International Relations and Collaborations	0.42	0.34	0.54
Basic general technical knowledge of the profession of your work area	0.41	0.27	0.54
Capacity to learn	0.41	0.37	0.44
Knowledge of a second language	0.4	0.17	0.61
Appreciation of ethical issues	0.39	0.29	0.51
Oral and written communication in your native language	0.36	0.37	0.37
Will to succeed	0.36	0.32	0.41
Research skills	0.33	0.41	0.24
Grounding in basic knowledge of the profession of your work area	0.26	0.05	0.44
Appreciation of diversity and multiculturality	0.26	0.1	0.46
Understanding of cultures and customs of other countries	0.14	0.15	0.17
Elementary computing skills	0.09	0.1	0.1

Table 6.4(a) Comparison of mean difference between rated importance and level of development of the generic competences for all employers and by country (sorted by total).

Generic competence	Bulgaria	France	Germany	Ireland	Poland	Slovak Republic	Total
Concern for quality	0.7	0.14	0.7	0.83	1.15	0.86	0.79
Planning and time management	0.6	0.29	0.9	0.44	1.31	0.71	0.75
Capacity for applying knowledge in practice	0.75	0.43	0.4	0.5	1	0.86	0.74
Problem solving	0.65	0.71	0.2	0.78	1.15	0.71	0.72
Teamworking	0.5	0.86	0.3	0.94	0.69	0.71	0.72
Ability to work autonomously	0.5	0.29	0.5	0.44	1.15	1.14	0.66
Capacity to adapt to new situations	0.7	0.86	0.2	0.33	1.15	0.71	0.65
Initiative and entrepreneurial spirit	0.7	0.71	0.6	0.44	0.77	0.43	0.62
Capacity for generating new ideas (creativity)	0.7	0.43	0.6	0.5	0.69	0.57	0.6
Decision making	0.75	0.29	0.5	0.61	0.69	0.57	0.6
Ability to communicate with non-experts (in the field)	0.3	0.57	0.4	0.56	0.69	0.29	0.56
Ability to work in an interdisciplinary team	0.45	-0.14	0.5	0.61	0.31	0.86	0.54
Interpersonal skills	0.45	0.14	0.2	0.56	0.92	0.14	0.49
Information management skills	0.4	0.71	0.2	0.33	0.77	0.57	0.48
Project design and management	0.15	0.57	0.3	0.67	0.77	0.71	0.48
Capacity for analysis and synthesis	0.45	0.29	-0.1	0.33	0.92	0.43	0.47
Critical and self-critical abilities	0.35	0.71	0.4	0.39	0.62	0.57	0.47
Leadership	0.75	0	0.1	0.39	0.62	0.29	0.46
Ability to work in an international context	0.35	0.43	0.5	0.22	0.54	0.71	0.44
Patents and Intellectual Property Rights	0.25	0.29	0.8	0.61	0.08	0.43	0.44
International Relations and Collaborations	0.4	0	0.6	0.44	0.54	0.43	0.42
Basic general technical knowledge of the profession of your work area	0.3	0	0.1	0.22	0.92	0.86	0.41
Capacity to learn	0.45	0.29	0.3	0.22	0.62	0.29	0.41
Knowledge of a second language	0.7	0.29	-0.1	-0.39	1	0.86	0.4
Appreciation of ethical issues	0.35	-0.14	0.6	0.44	0.23	0.29	0.39
Oral and written communication in your native language	0.1	0	0.2	0.67	0.38	0.57	0.36
Will to succeed	0.25	0.71	0.2	0.17	0.85	0.43	0.36
Research skills	0.55	0.14	0	0.39	0.23	0.14	0.33
Grounding in basic knowledge of the profession of your work area	0	0.29	0	-0.06	0.77	0.57	0.26
Appreciation of diversity and multiculturality	0.05	-0.14	0.5	0.06	0.31	0.57	0.26
Understanding of cultures and customs of other countries	-0.05	0	0.4	0.06	0	0.29	0.14
Elementary computing skills	0.2	0.14	-0.1	-0.06	0.23	0.29	0.09

Table 6.6 Employer perception of importance of the specific competences by academic level

Specific competence	All	Bachelor	Master
26. Ability to demonstrate awareness of quality issues	3.34	3.44	3.23
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	3.28	3.33	3.2
23. Ability to demonstrate understanding of the use of technical literature and other information sources	3.27	3.47	3.03
28. Ability to work in a group on a major project	3.25	3.36	3.13
8. Ability to apply a systems approach to engineering problems	3.24	3.31	3.13
21. Ability to demonstrate practical engineering skills	3.24	3.42	3.03
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.22	3.31	3.13
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	3.21	3.28	3.13
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.21	3.36	3.03
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	3.19	3.28	3.1
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	3.15	3.36	2.87
11. Ability to identify and manage cost drivers in designs and projects	3.13	3.19	3.07
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	3.12	3.08	3.13
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	3.09	3.11	3.03
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	3.09	3.28	2.87
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	3.06	3.06	3.07
27. Ability to work with technical uncertainty	3.04	3.11	2.97
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	3.01	3.06	2.93
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	3	3.17	2.8
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	3	3.08	2.9
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.99	3.06	2.9
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.97	3.11	2.8
14. Ability to manage the design process and evaluate outcomes	2.96	3.17	2.7
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.91	3	2.8
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.9	2.97	2.8
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.87	2.81	2.93
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.79	2.72	2.87
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.76	2.83	2.67

Table 6.6(a) Employer perception of importance of the specific competences by country

Specific competence	Bulgaria	France	Germany	Ireland	Total
26. Ability to demonstrate awareness of quality issues	3.4	3.4	3.3	3.44	3.4
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	3.3	3.8	3.3	3.39	3.38
21. Ability to demonstrate practical engineering skills	3.25	3.6	3.3	3.33	3.32
23. Ability to demonstrate understanding of the use of technical literature and other information sources	3.2	3.4	3.3	3.44	3.32
28. Ability to work in a group on a major project	3.25	3.4	3.4	3.22	3.28
11. Ability to identify and manage cost drivers in designs and projects	3.25	3.4	3	3.39	3.26
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.1	3.4	3.3	3.33	3.25
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	3.05	3.4	3.2	3.44	3.25
8. Ability to apply a systems approach to engineering problems	3.25	3.6	3.2	3.17	3.25
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	2.9	3.4	3.5	3.39	3.23
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	3	3.6	3.2	3.28	3.19
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2.9	3.4	3.1	3.39	3.15
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	3	3.6	3.1	3.17	3.13
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	3.1	3.4	2.9	3.22	3.13
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.9	3.4	3.3	3.22	3.13
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	3	3.6	3.2	2.94	3.08
27. Ability to work with technical uncertainty	2.95	2.8	3.3	3.17	3.08
14. Ability to manage the design process and evaluate outcomes	2.9	3.6	3.1	3.06	3.06
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	3	3.2	3	3.11	3.06
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2.7	3.6	3.2	3.17	3.04
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2.95	3.2	3	3.11	3.04
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.9	3.4	2.9	3.11	3.02
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.7	3.2	3.1	3.22	3
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.6	3.2	3.2	3	2.91
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.65	3.2	2.9	3.11	2.91
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.7	2.8	2.9	3.11	2.89
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.65	3	2.7	3	2.81

18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.55	3.2	2.6	3	2.77

Table 6.7 Employer perception of level of development of the specific competences by academic level

Specific competences	All	Bachelor	Master
23. Ability to demonstrate understanding of the use of technical literature and other information sources	3.01	3.19	2.8
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	2.9	2.83	2.97
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	2.87	2.97	2.73
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2.82	2.92	2.7
21. Ability to demonstrate practical engineering skills	2.78	2.94	2.57
8. Ability to apply a systems approach to engineering problems	2.69	2.72	2.6
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	2.66	2.69	2.6
26. Ability to demonstrate awareness of quality issues	2.64	2.67	2.6
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	2.61	2.58	2.6
28. Ability to work in a group on a major project	2.61	2.72	2.47
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	2.6	2.67	2.47
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2.6	2.67	2.5
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.57	2.64	2.47
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2.57	2.72	2.33
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.52	2.5	2.53
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	2.51	2.61	2.37
27. Ability to work with technical uncertainty	2.51	2.56	2.43
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2.49	2.69	2.23
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	2.48	2.44	2.47
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.45	2.33	2.53
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.45	2.5	2.37
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.4	2.56	2.2
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.37	2.36	2.37
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.33	2.44	2.17
14. Ability to manage the design process and evaluate outcomes	2.31	2.47	2.1
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.3	2.36	2.2
11. Ability to identify and manage cost drivers in designs and projects	2.22	2.36	2.03
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.22	2.33	2.07

Table 6.7(a) Employer perception of level of development of the specific competences by country

Specific competence	Bulgaria	France	Germany	Ireland	Total
23. Ability to demonstrate understanding of the use of technical literature and other information sources	2.7	3.2	3.2	3.44	3.09
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	2.7	3	2.9	3.11	2.91
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	2.8	3	2.5	3.06	2.85
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2.7	3.2	2.6	3.06	2.85
21. Ability to demonstrate practical engineering skills	2.45	3.4	2.9	2.94	2.79
8. Ability to apply a systems approach to engineering problems	2.55	3.2	2.8	2.78	2.74
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	2.55	3.2	2.4	2.83	2.68
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	2.55	3	2.6	2.72	2.66
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	2.6	3.2	2.8	2.5	2.66
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2.45	3	2.8	2.67	2.64
26. Ability to demonstrate awareness of quality issues	2.6	3	2.6	2.61	2.64
28. Ability to work in a group on a major project	2.2	2.6	2.9	3	2.64
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2.4	2.8	2.5	2.83	2.6
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.35	2.8	2.5	2.83	2.58
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2.35	2.8	2.7	2.67	2.57
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.5	2.4	2.7	2.56	2.55
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	2.4	3	2.6	2.56	2.55
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	2.4	2.8	2.6	2.5	2.51
27. Ability to work with technical uncertainty	2.35	2.6	2.8	2.5	2.51
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.65	2.2	2.3	2.5	2.49
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.35	2.8	2.7	2.44	2.49
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.1	3	2.7	2.56	2.45
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.3	2.2	2.8	2.39	2.42
14. Ability to manage the design process and evaluate outcomes	2.2	3.2	2.4	2.33	2.38
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.1	2.4	2.6	2.44	2.34
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.05	2.4	2.7	2.39	2.32
11. Ability to identify and manage cost drivers in designs and projects	2.1	2.6	2.4	2.28	2.26
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	1.85	2.8	2.5	2.44	2.26

Table 6.8 Comparison of mean difference between rated importance and level of development for all employers and by level of study.

Specific competence	All	Bachelor	Master
11. Ability to identify and manage cost drivers in designs and projects	0.91	0.83	1.03
26. Ability to demonstrate awareness of quality issues	0.7	0.78	0.63
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.69	0.67	0.73
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	0.69	0.72	0.67
14. Ability to manage the design process and evaluate outcomes	0.64	0.69	0.6
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.64	0.67	0.63
28. Ability to work in a group on a major project	0.64	0.64	0.67
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	0.61	0.67	0.57
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.6	0.61	0.6
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	0.57	0.72	0.4
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	0.57	0.39	0.8
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	0.55	0.58	0.53
8. Ability to apply a systems approach to engineering problems	0.55	0.58	0.53
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	0.55	0.44	0.7
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	0.55	0.36	0.8
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.54	0.78	0.27
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	0.54	0.56	0.53
27. Ability to work with technical uncertainty	0.54	0.56	0.53
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	0.51	0.39	0.67
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	0.49	0.44	0.57
21. Ability to demonstrate practical engineering skills	0.46	0.47	0.47
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	0.46	0.47	0.47
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	0.37	0.47	0.27
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.34	0.39	0.3
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.34	0.36	0.33
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.33	0.47	0.17
23. Ability to demonstrate understanding of the use of technical literature and other information sources	0.25	0.28	0.23
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	0.18	0.25	0.1

Table 6.9 Comparison of mean difference between rated importance and level of development of the specific competences for all employers and by country (sorted by total).

Specific competence	Bulgaria	France	Germany	Ireland	Slovak Republic	Total
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	0.25	1.2	0.6	0.61	0.17	0.57
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	0.7	0.4	0.1	0.56	0.33	0.57
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	0.5	0.2	0.8	0.61	0.33	0.55
8. Ability to apply a systems approach to engineering problems	0.7	0.4	0.4	0.39	1	0.55
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	0.6	0.6	0.6	0.39	0.33	0.55
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	0.65	0.4	0.1	0.56	0.67	0.55
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.45	0.6	0.6	0.56	0.5	0.54
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	0.9	0.2	0.3	0.56	0	0.54
27. Ability to work with technical uncertainty	0.6	0.2	0.5	0.67	0	0.54
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	0.6	0.4	0.3	0.44	0.67	0.51
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	0.4	0.6	0.1	0.72	0.33	0.49
21. Ability to demonstrate practical engineering skills	0.8	0.2	0.4	0.39	-0.17	0.46
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	0.55	0.6	0.1	0.56	0.17	0.46
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	0.1	0.8	0.5	0.44	0.33	0.37
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.2	0.4	0.6	0.28	0.17	0.34
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.3	0.4	0.4	0.28	0.33	0.34
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.3	0.4	0.8	0.28	-0.17	0.33
23. Ability to demonstrate understanding of the use of technical literature and other information sources	0.5	0.2	0.1	0	0	0.25
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	0	0.4	0.6	0.11	-0.33	0.18

26. Ability to demonstrate awareness of quality issues	0.8	0.4	0.7	0.83	0	0.7
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.5	0.6	0.6	0.56	0.33	0.6
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	0.6	0.8	0.5	0.67	0	0.61
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.7	0.6	0.5	0.89	0.33	0.69
11. Ability to identify and manage cost drivers in designs and projects	1.15	0.8	0.6	1.11	0.5	0.91
14. Ability to manage the design process and evaluate outcomes	0.7	0.4	0.7	0.72	0.17	0.64
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.65	0.8	0.4	0.83	0.33	0.64
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	0.55	0.6	0.6	0.78	0.67	0.69
28. Ability to work in a group on a major project	1.05	0.8	0.5	0.22	0.17	0.64

Table 7.2 Mean preparedness for work by graduates by country

Country	Mean
Bulgaria	1.50
Greece	2.21
Ireland	1.56
Poland	2.71
Portugal	2.15
Slovak Republic	2.38
Spain	2.56
Turkey	2.03

Table 7.3 Mean of importance of the generic competences for all graduates and by level of study

Generic competence	All	Bachelor	Master
Problem solving – Importance	3.59	3.71	3.53
Capacity for applying knowledge in practice – Importance	3.53	3.6	3.49
Elementary computing skills – Importance	3.51	3.59	3.47
Capacity for analysis and synthesis – Importance	3.49	3.58	3.45
Capacity to learn – Importance	3.48	3.59	3.42
Information management skills – Importance	3.42	3.44	3.41
Teamworking – Importance	3.36	3.52	3.31
Planning and time management – Importance	3.33	3.4	3.29
Capacity for generating new ideas (creativity) – Importance	3.33	3.39	3.31
Basic general technical knowledge of the profession of your work area – Importance	3.32	3.39	3.28
Capacity to adapt to new situations – Importance	3.32	3.52	3.21
Will to succeed – Importance	3.28	3.28	3.29
Decision making – Importance	3.27	3.29	3.28
Ability to work autonomously – Importance	3.27	3.32	3.27
Concern for quality – Importance	3.26	3.31	3.27
Oral and written communication in your native language – Importance	3.19	3.2	3.17
Research skills -Importance	3.19	3.27	3.1
Grounding in basic knowledge of the profession of your work area – Importance	3.17	3.13	3.15
Knowledge of a second language – Importance	3.15	3.02	3.2
Project design and management – Importance	3.14	3.22	3.13
Ability to work in an international context – Importance	3.08	3.12	3.07
Ability to work in an interdisciplinary team – Importance	3.06	3.15	3.01
Interpersonal skills – Importance	3.04	3.12	2.99
Critical and self-critical abilities – Importance	3.02	3.15	2.97
Ability to communicate with non-experts (in the field) – Importance	2.99	3.09	2.93
Initiative and entrepreneurial spirit – Importance	2.91	3	2.86
Leadership – Importance	2.9	2.98	2.86
International Relations and Collaborations – Importance	2.9	2.88	2.92
Patents and Intellectual Property Rights – Importance	2.8	2.73	2.83
Appreciation of ethical issues – Importance	2.68	2.64	2.72
Appreciation of diversity and multiculturality – Importance	2.67	2.62	2.71
Understanding of cultures and customs of other countries – Importance	2.43	2.39	2.47

Table 7.3(a) Mean of importance of the generic competences for all graduates and by country

Generic competence	Bulgaria	Greece	Ireland	Poland	Slovak Republic	Spain	Turkey	Total
Problem solving – Importance	3.66	3.79	3.78	3.04	3.73	3.63	3.7	3.59
Capacity for applying knowledge in practice – Importance	3.68	3.48	3.83	3.08	3.55	3.51	3.67	3.51
Elementary computing skills	3.52	3.76	3.83	3.12	3.58	3.41	3.7	3.51
Capacity for analysis and	3.62	3.62	3.61	3	3.48	3.46	3.7	3.47
Capacity to learn – Importance	3.52	3.52	3.83	2.96	3.52	3.61	3.64	3.47
Information management skills	3.58	3.38	3.72	3.02	3.58	3.29	3.48	3.42
Teamworking – Importance	3.66	3.59	3.33	2.98	3.39	3.27	3.27	3.35
Capacity for generating new ideas (creativity) – Importance	3.42	3.45	3.56	2.94	3.44	3.24	3.42	3.33
Planning and time management – Importance	3.48	3.24	3.67	2.86	3.29	3.46	3.36	3.3
Basic general technical knowledge of the profession of your work area – Importance	3.52	3.52	3.39	2.6	3.48	3.39	3.3	3.3
Capacity to adapt to new situations – Importance	3.36	3.62	3.44	2.98	3.27	3.2	3.36	3.28
Ability to work autonomously – Importance	3.38	3.66	3.33	2.96	3.32	3.12	3.21	3.26
Concern for quality – Importance	3.46	3.31	3.67	3	3.37	2.83	3.36	3.25
Will to succeed – Importance	3.58	3.34	3.72	2.86	3.29	2.98	3.3	3.25
Decision making – Importance	3.6	3.38	3.5	3.02	3.19	2.95	3.24	3.24
Oral and written communication in your native language – Importance	3.58	3.17	3.61	2.72	3.39	2.76	3.06	3.17
Grounding in basic knowledge of the profession of your work area – Importance	3.44	3.14	3.33	2.38	3.42	3.12	3.27	3.14
Research skills -Importance	3.36	3.55	3.61	2.12	3.27	3.15	3.52	3.14
Knowledge of a second language – Importance	3.36	3.55	1.5	2.5	3.53	3.34	3.24	3.13
Project design and management – Importance	3.26	3.24	3.56	2.74	3.19	3.1	3.12	3.13
Ability to work in an international context – Importance	3.44	3.41	3.28	2.42	3.21	2.85	3.15	3.08
Ability to work in an interdisciplinary team – Importance	3.18	3.17	3.56	2.54	3.16	2.93	3.12	3.04
Critical and self-critical abilities – Importance	3.18	3.14	3.44	2.48	3.13	2.93	3.09	3.01
Interpersonal skills – Importance	3.32	3.07	3.28	2.72	3.05	2.83	2.94	3.01
Ability to communicate with non-experts (in the field) – Importance	3.12	3.17	3.33	2.68	3	2.9	2.94	2.98
Initiative and entrepreneurial spirit – Importance	3.04	2.97	3.22	2.68	2.85	2.78	2.82	2.88
International Relations and Collaborations – Importance	3.42	3.03	3.22	2.42	2.87	2.61	2.76	2.88
Leadership – Importance	3.18	2.93	3.28	2.56	2.85	2.54	2.85	2.85
Patents and Intellectual Property Rights – Importance	3.16	2.72	3.22	2.64	2.71	2.34	2.88	2.78
Appreciation of diversity and multiculturality – Importance	3.2	2.86	2.94	2.5	2.48	2.22	2.61	2.66
Appreciation of ethical issues – Importance	3.16	2.55	3	2.5	2.68	2.24	2.58	2.66
Understanding of cultures and customs of other countries – Importance	3.08	2.55	2.94	2.18	2.23	1.98	2.24	2.41

Table 7.4 Weighted ranking of importance of generic competences by graduates for all and by study level

Generic competence	All	Bachelor	Masters
Capacity for applying knowledge in practice	458	116	304
Problem solving	451	118	292
Capacity for analysis and synthesis	403	113	250
Teamworking	369	82	253
Capacity to learn	300	88	187
Decision making	233	45	170
Knowledge of a second language	201	48	137
Capacity for generating new ideas (creativity)	191	74	96
Planning and time management	177	51	103
Research skills	160	29	112
Basic general technical knowledge of the profession of your work area	159	34	110
Capacity to adapt to new situations	132	31	92
Elementary computing skills	124	48	70
Ability to work autonomously	112	20	83
Project design and management	112	38	65
Will to succeed	104	29	71
Information management skills	100	33	60
Grounding in basic knowledge of the profession of your work area	90	32	53
Concern for quality	76	33	38
Leadership	71	35	34
Interpersonal skills	70	10	48
Initiative and entrepreneurial spirit	67	18	46
Ability to work in an interdisciplinary team	66	24	36
Ability to work in an international context	52	13	37
Ability to communicate with non-experts (in the field)	46	16	26
Oral and written communication in your native language	42	9	29
Critical and self-critical abilities	39	12	27
International Relations and Collaborations	27	1	24
Appreciation of diversity and multiculturality	20	7	10
Understanding of cultures and customs of other countries	18	8	7
Patents and Intellectual Property Rights	15	5	10
Appreciation of ethical issues	10	5	5

Table 7.5 Graduate view of mean level of development for the generic competences by academic level

Generic competence	All	Bachelor	Master
Elementary computing skills – Level	3.32	3.34	3.32
Capacity to learn – Level	3.19	3.21	3.18
Problem solving – Level	3.15	3.07	3.15
Capacity for analysis and synthesis – Level	3.12	3.07	3.13
Teamworking – Level	3.08	2.95	3.12
Information management skills – Level	3.01	2.86	3.06
Capacity for applying knowledge in practice – Level	2.99	2.89	3
Basic general technical knowledge of the profession of your work area – Level	2.99	2.94	3.01
Ability to work autonomously – Level	2.98	2.88	3.01
Grounding in basic knowledge of the profession of your work area – Level	2.95	2.89	2.98
Will to succeed – Level	2.94	2.84	2.97
Oral and written communication in your native language – Level	2.9	2.87	2.92
Research skills – Level	2.87	2.84	2.85
Concern for quality – Level	2.86	2.79	2.89
Decision making – Level	2.82	2.62	2.9
Capacity to adapt to new situations – Level	2.8	2.79	2.78
Project design and management – Level	2.71	2.68	2.72
Capacity for generating new ideas (creativity) – Level	2.69	2.65	2.69
Critical and self-critical abilities – Level	2.68	2.59	2.69
Planning and time management – Level	2.66	2.64	2.63
Interpersonal skills – Level	2.66	2.67	2.66
Ability to work in an interdisciplinary team – Level	2.51	2.44	2.52
Knowledge of a second language – Level	2.45	2.29	2.53
Ability to communicate with non-experts (in the field) – Level	2.45	2.33	2.45
Appreciation of ethical issues – Level	2.43	2.28	2.49
Initiative and entrepreneurial spirit – Level	2.4	2.42	2.39
Ability to work in an international context – Level	2.38	2.32	2.37
Appreciation of diversity and multiculturality – Level	2.35	2.27	2.4
Leadership – Level	2.33	2.24	2.38
Patents and Intellectual Property Rights – Level	2.31	2.18	2.39
International Relations and Collaborations – Level	2.3	2.16	2.38
Understanding of cultures and customs of other countries – Level	2.07	1.92	2.14

Table 7.5(a) Graduate view of mean level of development for the generic competences by country

Generic competence	Bulgaria	Greece	Ireland	Poland	Slovak Republic	Spain	Turkey	Total
Elementary computing skills – Level	3.2	3.24	3.56	3.34	3.24	3.37	3.64	3.34
Capacity to learn – Level	3.06	3.14	3.33	3.1	3.18	3.41	3.3	3.2
Problem solving – Level	3.46	3.1	3.33	2.94	3.08	2.98	3.39	3.16
Capacity for analysis and synthesis	3.18	3.07	3.11	3.02	3.05	3.22	3.27	3.12
Teamworking – Level	3.34	2.97	2.94	3.32	2.9	2.95	3	3.08
Information management skills – Level	3	2.76	3.11	3.12	3.05	2.9	3.15	3.02
Capacity for applying knowledge in practice – Level	3.4	2.9	2.94	2.72	2.92	2.88	3.15	2.99
Basic general technical knowledge of the profession of your work area – Level	3.02	3.28	2.94	2.74	3.19	2.76	2.97	2.99
Ability to work autonomously – Level	2.96	2.9	3.11	3.06	3.02	2.85	2.94	2.98
Grounding in basic knowledge of the profession of your work area – Level	2.8	2.97	3.06	2.88	3.15	2.83	3	2.95
Will to succeed – Level	3.12	3.03	3.17	3.06	2.79	2.61	3	2.94
Oral and written communication in your native language – Level	3.08	2.79	3	2.98	2.94	2.76	2.85	2.92
Research skills – Level	2.98	2.72	3.11	2.68	2.87	2.73	3.12	2.87
Concern for quality – Level	3.1	2.79	2.94	2.98	2.77	2.61	2.91	2.87
Decision making – Level	3.36	2.69	2.5	2.86	2.68	2.39	3.03	2.82
Capacity to adapt to new situations – Level	2.74	2.66	2.72	2.92	2.79	2.63	3.06	2.8
Project design and management – Level	2.78	2.55	2.89	2.88	2.63	2.49	2.79	2.71
Capacity for generating new ideas (creativity) – Level	2.84	2.62	2.44	2.78	2.65	2.41	2.88	2.68
Critical and self-critical abilities – Level	2.66	2.55	2.56	2.86	2.58	2.54	2.88	2.67
Interpersonal skills – Level	2.8	2.66	2.56	2.96	2.52	2.39	2.7	2.66
Planning and time management – Level	2.74	2.66	2.56	2.72	2.52	2.63	2.7	2.65
Ability to work in an interdisciplinary team – Level	2.58	2.48	2.11	2.66	2.6	2.2	2.67	2.51
Ability to communicate with non-experts (in the field) – Level	2.62	2.55	2.39	2.6	2.37	2.12	2.45	2.45
Knowledge of a second language – Level	2.78	2.59	1.5	2.28	2.48	2.12	2.85	2.44
Appreciation of ethical issues – Level	2.62	2.14	1.78	2.66	2.39	2.32	2.45	2.41
Ability to work in an international context – Level	2.84	2.45	2	2.2	2.35	2.15	2.33	2.37
Initiative and entrepreneurial spirit	2.56	2.28	2.33	2.38	2.23	2.24	2.58	2.37
Appreciation of diversity and multiculturality – Level	2.66	2.24	2.06	2.62	2.19	2.2	2.3	2.36
Leadership – Level	2.62	2.21	2.11	2.56	2.15	1.93	2.58	2.33
Patents and Intellectual Property Rights – Level	2.62	2.21	1.89	2.98	2	1.73	2.33	2.3

International Relations and Collaborations – Level	2.94	2.21	2.22	2.14	2.21	1.88	2.12	2.27
Understanding of cultures and customs of other countries – Level	2.7	2.07	1.56	2	1.89	1.76	2	2.04

Table 7.6 Comparison of mean difference between rated importance and level of development of the generic competences for all graduates and by academic level.

Generic competence	All	Bachelor	Master
Will to succeed	0.34	0.45	0.32
Understanding of cultures and customs of other countries	0.37	0.47	0.33
Teamworking	0.28	0.56	0.18
Research skills	0.31	0.44	0.25
Project design and management	0.42	0.54	0.41
Problem solving	0.44	0.64	0.38
Planning and time management	0.67	0.76	0.66
Patents and Intellectual Property Rights	0.49	0.55	0.44
Oral and written communication in your native language	0.28	0.33	0.24
Leadership	0.56	0.74	0.49
Knowledge of a second language	0.7	0.73	0.67
Interpersonal skills	0.38	0.45	0.33
International Relations and Collaborations	0.59	0.72	0.55
Initiative and entrepreneurial spirit	0.51	0.58	0.47
Information management skills	0.41	0.58	0.35
Grounding in basic knowledge of the profession of your work area	0.22	0.24	0.17
Elementary computing skills	0.19	0.25	0.15
Decision making	0.46	0.67	0.38
Critical and self-critical abilities	0.34	0.56	0.28
Concern for quality	0.41	0.52	0.38
Capacity to learn	0.29	0.38	0.24
Capacity to adapt to new situations	0.51	0.73	0.43
Capacity for generating new ideas (creativity)	0.64	0.74	0.61
Capacity for applying knowledge in practice	0.54	0.71	0.49
Capacity for analysis and synthesis	0.36	0.51	0.32
Basic general technical knowledge of the profession of your work area	0.33	0.45	0.27
Appreciation of ethical issues	0.26	0.35	0.24
Appreciation of diversity and multiculturality	0.32	0.35	0.31
Ability to work in an international context	0.7	0.8	0.7
Ability to work in an interdisciplinary team	0.55	0.72	0.5
Ability to work autonomously	0.29	0.44	0.25
Ability to communicate with non-experts (in the field)	0.54	0.76	0.49

Table 7.6(a) Comparison of mean difference between rated importance and level of development of the generic competences for all graduates and by country.

Generic competence	Bulgaria	Greece	Ireland	Poland	Slovak Republic	Spain	Turkey	Total
Ability to work in an international context	0.6	0.97	1.28	0.22	0.85	0.71	0.82	0.73
Knowledge of a second language	0.58	0.97	0	0.22	1.05	1.22	0.39	0.7
Planning and time management	0.74	0.59	1.11	0.14	0.77	0.83	0.67	0.68
Capacity for generating new ideas (creativity)	0.58	0.83	1.11	0.16	0.79	0.83	0.55	0.64
International Relations and Collaborations	0.48	0.83	1	0.28	0.66	0.73	0.64	0.6
Leadership	0.56	0.72	1.17	0	0.71	0.61	0.27	0.56
Ability to work in an interdisciplinary team	0.6	0.69	1.44	-0.12	0.56	0.73	0.45	0.56
Capacity for applying knowledge in practice	0.28	0.59	0.89	0.36	0.63	0.63	0.52	0.54
Ability to communicate with non-experts (in the field)	0.5	0.62	0.94	0.08	0.63	0.78	0.48	0.53
Capacity to adapt to new situations	0.62	0.97	0.72	0.06	0.48	0.56	0.3	0.52
Initiative and entrepreneurial spirit	0.48	0.69	0.89	0.3	0.63	0.54	0.24	0.52
Patents and Intellectual Property Rights	0.54	0.52	1.33	-0.34	0.71	0.61	0.55	0.49
Decision making	0.24	0.69	1	0.16	0.52	0.56	0.21	0.47
Problem solving	0.2	0.69	0.44	0.1	0.65	0.66	0.3	0.45
Project design and management	0.48	0.69	0.67	-0.14	0.56	0.61	0.33	0.43
Information management skills	0.58	0.62	0.61	-0.1	0.53	0.39	0.33	0.42
Concern for quality	0.36	0.52	0.72	0.02	0.6	0.22	0.45	0.42
Interpersonal skills	0.52	0.41	0.72	-0.24	0.53	0.44	0.24	0.38
Understanding of cultures and customs of other countries	0.38	0.48	1.39	0.18	0.34	0.22	0.24	0.38
Capacity for analysis and synthesis	0.44	0.55	0.5	-0.02	0.44	0.24	0.42	0.37
Critical and self-critical abilities	0.52	0.59	0.89	-0.38	0.55	0.39	0.21	0.36
Will to succeed	0.46	0.31	0.56	-0.2	0.5	0.37	0.3	0.35
Basic general technical knowledge of the profession of your work area	0.5	0.24	0.44	-0.14	0.29	0.63	0.33	0.33
Research skills	0.38	0.83	0.5	-0.56	0.4	0.41	0.39	0.32
Appreciation of diversity and multiculturality	0.54	0.62	0.89	-0.12	0.29	0.02	0.3	0.32
Capacity to learn	0.46	0.38	0.5	-0.14	0.34	0.2	0.33	0.3
Ability to work autonomously	0.42	0.76	0.22	-0.1	0.31	0.27	0.27	0.3
Oral and written communication in your native language	0.5	0.38	0.61	-0.26	0.45	0	0.21	0.28
Teamworking	0.32	0.62	0.39	-0.34	0.48	0.32	0.27	0.28
Appreciation of ethical issues	0.54	0.41	1.22	-0.16	0.29	-0.07	0.12	0.26
Grounding in basic knowledge of the profession of your work area	0.64	0.17	0.28	-0.5	0.27	0.29	0.27	0.21
Elementary computing skills	0.32	0.52	0.28	-0.22	0.34	0.05	0.06	0.19

Table 7.8 Graduate perception of importance of the specific competences by academic level

Specific competence	All	Bachelor	Master
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.34	3.36	3.35
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.33	3.35	3.34
28. Ability to work in a group on a major project	3.33	3.29	3.35
23. Ability to demonstrate understanding of the use of technical literature and other information sources	3.23	3.15	3.28
21. Ability to demonstrate practical engineering skills	3.15	3.14	3.18
8. Ability to apply a systems approach to engineering problems	3.13	3.26	3.1
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	3.1	3.13	3.09
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	3.08	3.05	3.11
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	3.07	3.11	3.07
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	3.07	3.2	3.07
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	3.06	3.06	3.06
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	3.01	3.15	2.98
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2.96	2.91	3
26. Ability to demonstrate awareness of quality issues	2.95	2.85	3.03
14. Ability to manage the design process and evaluate outcomes	2.93	2.87	2.93
11. Ability to identify and manage cost drivers in designs and projects	2.91	2.88	2.91
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	2.9	2.84	2.98
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.88	2.79	2.92
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.87	2.78	2.94
27. Ability to work with technical uncertainty	2.87	2.65	2.96
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2.83	2.89	2.83
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.8	2.87	2.78
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.8	2.65	2.87
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.78	2.72	2.81
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.78	2.66	2.81
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.74	2.76	2.73
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.7	2.67	2.72
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.61	2.53	2.68

Table 7.8(a) Graduate perception of importance of the specific competences by country

Generic competence	Bulgaria	Greece	Ireland	Poland	Slovak Republic	Spain	Turkey	Total
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.78	3.38	3.67	2.62	3.6	3.17	3.36	3.35
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.54	3.17	3.61	2.68	3.5	3.44	3.55	3.33
28. Ability to work in a group on a major project	3.66	3.21	3.78	2.86	3.42	3.39	3.18	3.33
23. Ability to demonstrate understanding of the use of technical literature and other information sources	3.48	3.03	3.39	2.76	3.44	3.22	3.42	3.25
21. Ability to demonstrate practical engineering skills	3.4	3.07	3.61	2.68	3.23	3.2	3.24	3.17
8. Ability to apply a systems approach to engineering problems	3.28	3.14	3.5	2.34	3.45	3	3.39	3.12
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	3.6	3.38	3.39	2.66	2.97	3.02	3.03	3.11
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	3.38	3.14	3.22	2.56	3.34	2.9	3.12	3.09
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	3.66	3.28	3.06	2.44	3.24	2.88	3	3.08
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	3.48	3.03	3.5	2.14	3.27	3.07	3.24	3.07
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	3.3	2.97	3.44	2.6	3.06	3.2	3.15	3.07
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	3.44	2.83	3.28	2.52	3.06	2.78	3.12	2.99
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	3.44	3.07	2.78	2.3	3.06	3.02	3.12	2.98
26. Ability to demonstrate awareness of quality issues	3.48	2.97	2.94	2.62	2.94	2.83	3.09	2.98
14. Ability to manage the design process and evaluate outcomes	3.36	3.03	3.28	2.4	2.89	2.8	2.91	2.92
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	3.3	2.83	2.67	2.34	3.05	2.98	3.15	2.92

4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	3.34	2.72	2.83	2.62	2.97	2.71	2.91	2.89
11. Ability to identify and manage cost drivers in designs and projects	3.32	3	3	2.46	2.77	2.71	3.18	2.89
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	3.24	2.86	2.89	2.62	2.85	2.83	2.97	2.89
27. Ability to work with technical uncertainty	3.22	2.38	3.06	2.5	3.03	2.88	3	2.88
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	3.2	2.79	3.11	2.48	2.73	2.98	2.64	2.82
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	3.32	2.69	2.67	2.5	2.9	2.56	2.94	2.82
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	3.28	3	3.11	2.52	2.65	2.66	2.67	2.81
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	3.24	2.55	3.17	2.4	2.79	2.63	3.06	2.81
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	3.4	2.79	2.83	2.28	2.9	2.59	2.55	2.78
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	3.38	2.9	2.94	2.28	2.63	2.59	2.58	2.73
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	3.28	2.72	3	2.38	2.66	2.44	2.67	2.72
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	3.28	2.55	2.72	2.14	2.65	2.34	2.64	2.62

Table 7.9 Graduate perception of level of development of the specific competences by academic level

Specific competences	All	Bachelor	Master
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.16	3.05	3.23
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	3.09	3.07	3.13
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.02	3.04	3.04
23. Ability to demonstrate understanding of the use of technical literature and other information sources	2.93	2.85	3.02
28. Ability to work in a group on a major project	2.9	2.72	3
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	2.86	2.91	2.84
8. Ability to apply a systems approach to engineering problems	2.79	2.88	2.77
21. Ability to demonstrate practical engineering skills	2.77	2.62	2.86
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	2.68	2.54	2.74
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2.66	2.48	2.74
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	2.59	2.47	2.68
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.55	2.39	2.62
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	2.55	2.44	2.63
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	2.55	2.39	2.65
27. Ability to work with technical uncertainty	2.55	2.31	2.67
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2.54	2.42	2.61
26. Ability to demonstrate awareness of quality issues	2.49	2.32	2.58
14. Ability to manage the design process and evaluate outcomes	2.46	2.24	2.56
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2.4	2.33	2.43
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.4	2.33	2.43
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.4	2.27	2.5
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.36	2.15	2.46
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.32	2.14	2.38
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.32	2.15	2.41
11. Ability to identify and manage cost drivers in designs and projects	2.3	2.12	2.38
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.28	2.19	2.33
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.25	2.07	2.31
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.16	2.04	2.22

Table 7.9(a) Graduate perception of level of development of the specific competences by country

Generic competence	Bulgaria	Greece	Ireland	Poland	Slovak Republic	Spain	Turkey	Total
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.54	3	3.11	2.92	3.18	3.2	3.15	3.17
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	3.36	3.31	2.89	2.88	3.16	3.15	2.91	3.11
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.12	2.76	3.11	2.82	2.94	3.22	3.21	3.01
23. Ability to demonstrate understanding of the use of technical literature and other information sources	2.98	2.69	3	3.08	3	2.88	2.94	2.95
28. Ability to work in a group on a major project	3.44	2.59	2.83	3.08	2.74	2.61	2.88	2.91
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	3.02	2.9	2.89	2.62	2.71	2.88	3.09	2.85
21. Ability to demonstrate practical engineering skills	2.94	2.66	3.22	2.66	2.82	2.61	2.94	2.81
8. Ability to apply a systems approach to engineering problems	2.82	2.66	3.11	2.58	2.77	2.8	2.97	2.78
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	3.02	2.76	2.28	2.44	2.82	2.59	2.64	2.69
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2.9	2.48	2.56	2.78	2.53	2.46	3	2.68
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	2.78	2.48	2.11	2.72	2.66	2.34	2.61	2.59
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	3.26	2.66	2.22	2.42	2.44	2.15	2.7	2.58
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	2.96	2.38	2.22	2.46	2.66	2.41	2.48	2.57
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.92	2.31	2.22	2.56	2.58	2.44	2.55	2.56
27. Ability to work with technical uncertainty	2.78	1.9	2.67	2.6	2.58	2.39	2.82	2.55
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2.8	2.24	2.44	2.44	2.55	2.44	2.67	2.53

26. Ability to demonstrate awareness of quality issues	2.94	2.45	2.39	2.48	2.35	2.24	2.61	2.51
14. Ability to manage the design process and evaluate outcomes	3	2.17	2.5	2.5	2.29	2.29	2.45	2.47
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.72	2.21	2.06	2.42	2.44	2.34	2.48	2.43
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.72	2.41	2.33	2.54	2.26	2.2	2.3	2.41
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2.74	2.24	2.17	2.44	2.26	2.32	2.42	2.4
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.98	2.03	2.28	2.48	2.16	1.9	2.7	2.38
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.72	2.03	2.11	2.46	2.32	1.85	2.64	2.34
11. Ability to identify and manage cost drivers in designs and projects	2.7	2.14	2	2.44	2.19	2.05	2.45	2.32
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.98	2.28	1.83	2.32	2.34	1.71	2.36	2.32
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.68	2.48	2.06	2.22	2.23	2	2.33	2.3
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.8	2.17	2	2.26	2.16	1.83	2.27	2.25
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.72	2.21	1.94	2.06	2.15	1.78	2.27	2.19

Table 7.10 Comparison of mean difference between rated importance and level of development of the specific competences for all graduates and by level of study.

Specific competence	All	Bachelor	Master
11. Ability to identify and manage cost drivers in designs and projects	0.61	0.76	0.53
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.55	0.69	0.46
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.52	0.64	0.45
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	0.51	0.68	0.45
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	0.48	0.69	0.42
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.48	0.49	0.46
14. Ability to manage the design process and evaluate outcomes	0.47	0.64	0.37
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	0.47	0.58	0.42
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	0.47	0.51	0.44
26. Ability to demonstrate awareness of quality issues	0.46	0.53	0.45
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	0.45	0.49	0.45
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	0.43	0.68	0.3
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	0.43	0.56	0.4
28. Ability to work in a group on a major project	0.43	0.58	0.35
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	0.42	0.51	0.35
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	0.4	0.51	0.36
21. Ability to demonstrate practical engineering skills	0.38	0.52	0.32
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	0.35	0.45	0.33
8. Ability to apply a systems approach to engineering problems	0.34	0.38	0.33
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	0.33	0.4	0.3
27. Ability to work with technical uncertainty	0.32	0.34	0.29
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.31	0.32	0.29
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	0.31	0.42	0.26
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.3	0.34	0.29
23. Ability to demonstrate understanding of the use of technical literature and other information sources	0.29	0.31	0.26
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.22	0.29	0.23
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.18	0.32	0.12
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	-0.02	0.04	-0.06

Table 7.10(a) Comparison of mean difference between rated importance and level of development of the specific competences for all and by country (sorted by total).

Generic competence	Bulgaria	Greece	Ireland	Poland	Slovak Republic	Spain	Turkey	Total
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.34	0.72	1.17	0.24	0.53	0.88	0.33	0.55
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.5	0.72	1	0.16	0.52	0.76	0.48	0.52
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	0.6	0.52	1.06	0.3	0.42	0.66	0.33	0.51
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	0.58	0.72	0.94	0.02	0.47	0.76	0.3	0.49
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.6	0.66	0.56	0.04	0.58	0.71	0.3	0.48
14. Ability to manage the design process and evaluate outcomes	0.36	0.86	0.78	-0.1	0.6	0.51	0.45	0.47
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	0.42	0.52	1	-0.04	0.56	0.88	0.18	0.47
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	0.52	0.66	0.83	0.2	0.42	0.49	0.48	0.47
26. Ability to demonstrate awareness of quality issues	0.54	0.52	0.56	0.14	0.58	0.59	0.48	0.47
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	0.56	0.34	0.78	0.08	0.5	0.56	0.36	0.45
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	0.26	0.52	0.89	-0.08	0.63	0.73	0.36	0.43
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	0.46	0.55	0.94	0.04	0.47	0.66	0.21	0.42
28. Ability to work in a group on a major project	0.22	0.62	0.94	-0.22	0.68	0.78	0.3	0.42
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	0.48	0.69	0.56	-0.16	0.4	0.61	0.64	0.41
21. Ability to demonstrate practical engineering skills	0.46	0.41	0.39	0.02	0.4	0.59	0.3	0.36

20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	0.52	0.34	0.56	-0.38	0.39	0.63	0.55	0.35
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	0.42	0.41	0.61	0.06	0.39	0.27	0.36	0.34
8. Ability to apply a systems approach to engineering problems	0.46	0.48	0.39	-0.24	0.68	0.2	0.42	0.34
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.42	0.41	0.5	-0.14	0.56	0.22	0.33	0.31
27. Ability to work with technical uncertainty	0.44	0.48	0.39	-0.1	0.45	0.49	0.18	0.31
23. Ability to demonstrate understanding of the use of technical literature and other information sources	0.5	0.34	0.39	-0.32	0.44	0.34	0.48	0.28
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.46	0.14	0.61	-0.48	0.56	0.2	0.15	0.22
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.24	0.38	0.56	-0.3	0.42	-0.02	0.21	0.17
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	0.36	0.38	0.94	0.12	0.52	0.32	0.48	0.4
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.56	0.31	0.67	-0.16	0.4	0.24	0.36	0.3
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	0.54	0.34	0.72	-0.26	0.53	0.32	0.12	0.3
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	0.3	-0.03	0.17	-0.44	0.08	-0.27	0.09	-0.03
11. Ability to identify and manage cost drivers in designs and projects	0.62	0.86	1	0.02	0.58	0.66	0.73	0.61

Table 8.3 Comparison of importance of the generic competences across the stakeholders

Generic competence	Students		Graduates		Academics	Employers
	Male	Female	Male	Female	Mean	Mean
Capacity for analysis and synthesis – Importance	3.18	3.23	3.6	3.47	3.54	3.39
Capacity for applying knowledge in practice – Importance	3.38	3.41	3.57	3.71	3.6	3.46
Planning and time management – Importance	3.08	3.2	3.46	3.18	3.24	3.15
Basic general technical knowledge of the profession of your work area – Importance	3.24	3.23	3.34	3.59	3.55	3.37
Grounding in basic knowledge of the profession of your work area – Importance	3	3.09	3.1	3.24	3.34	3.24
Oral and written communication in your native language – Importance	3.09	3.17	3.26	2.94	3.43	3.46
Knowledge of a second language – Importance	3.22	3.27	2.97	3.24	3.15	2.56
Elementary computing skills – Importance	3.4	3.44	3.59	3.59	3.7	3.71
Research skills -Importance	2.93	3.1	3.25	3.35	2.85	2.9
Capacity to learn – Importance	3.28	3.36	3.62	3.47	3.54	3.54
Information management skills – Importance	3.14	3.22	3.46	3.35	3.45	3.39
Critical and self-critical abilities – Importance	2.94	2.94	3.15	3.18	3.23	2.85
Capacity to adapt to new situations – Importance	3.3	3.3	3.51	3.53	3.48	3.27
Capacity for generating new ideas (creativity) – Importance	3.28	3.35	3.4	3.35	3.41	3.44
Problem solving – Importance	3.46	3.33	3.72	3.65	3.58	3.54
Decision making – Importance	3.24	3.26	3.32	3.18	3.3	3.22
Teamworking – Importance	3.36	3.38	3.51	3.53	3.48	3.46
Interpersonal skills – Importance	3.05	3.15	3.19	2.82	3.19	3.17
Leadership – Importance	2.96	2.92	2.97	3	2.96	2.59
Ability to work in an interdisciplinary team – Importance	2.98	3.09	3.15	3.18	3.26	2.93
Ability to communicate with non-experts (in the field) – Importance	2.98	3.01	3.07	3.18	3.09	3.15
Appreciation of diversity and multiculturality – Importance	2.7	2.75	2.66	2.47	2.84	2.51
Ability to work in an international context – Importance	3.1	3.11	3.13	3.06	3.02	2.78
Understanding of cultures and customs of other countries – Importance	2.52	2.68	2.38	2.41	2.62	2.44
Ability to work autonomously – Importance	3.3	3.21	3.34	3.24	3.51	3.29
Project design and management – Importance	3.14	3.15	3.15	3.53	3.38	3.02
Initiative and entrepreneurial spirit – Importance	3.02	3.03	3.04	2.82	3.12	3.22
Appreciation of ethical issues – Importance	2.7	2.82	2.66	2.53	2.93	2.98
Concern for quality – Importance	3.25	3.3	3.43	2.82	3.45	3.51
Will to succeed – Importance	3.38	3.35	3.34	3.06	3.29	3.34
Patents and Intellectual Property Rights – Importance	2.77	2.78	2.82	2.35	2.67	2.49
International Relations and Collaborations – Importance	2.92	2.9	2.87	2.94	2.83	2.46

Table 8.5 Comparison of level of development of the generic competences across the stakeholders

Generic competence	Students		Graduates		Academics	Employers
	Male	Female	Male	Female	Mean	Mean
Capacity for analysis and synthesis – Level	2.77	2.8	3.06	3.12	3.18	3.07
Capacity for applying knowledge in practice – Level	2.8	2.73	2.96	2.65	3.11	2.93
Planning and time management – Level	2.52	2.56	2.65	2.59	2.57	2.59
Basic general technical knowledge of the profession of your work area – Level	2.88	2.82	3.01	2.65	3.32	3.1
Grounding in basic knowledge of the profession of your work area – Level	2.74	2.71	2.93	2.76	3.16	3.2
Oral and written communication in your native language – Level	2.68	2.77	2.96	2.53	2.83	3.1
Knowledge of a second language – Level	2.47	2.49	2.35	2.06	2.45	2.39
Elementary computing skills – Level	3.13	3.19	3.37	3.24	3.48	3.61
Research skills – Level	2.55	2.6	2.91	2.53	2.57	2.49
Capacity to learn – Level	2.88	2.85	3.28	2.94	3.08	3.17
Information management skills – Level	2.7	2.68	2.94	2.53	2.89	2.95
Critical and self-critical abilities – Level	2.47	2.49	2.62	2.47	2.63	2.44
Capacity to adapt to new situations – Level	2.67	2.63	2.87	2.47	2.79	2.8
Capacity for generating new ideas (creativity) – Level	2.54	2.48	2.71	2.41	2.79	2.8
Problem solving – Level	2.92	2.74	3.18	2.65	2.97	2.9
Decision making – Level	2.64	2.69	2.66	2.47	2.7	2.63
Teamworking – Level	2.84	3.02	3.06	2.53	2.92	2.71
Interpersonal skills – Level	2.52	2.62	2.81	2.12	2.77	2.76
Leadership – Level	2.26	2.28	2.35	1.76	2.48	2.29
Ability to work in an interdisciplinary team – Level	2.32	2.48	2.5	2.18	2.6	2.54
Ability to communicate with non-experts (in the field) – Level	2.42	2.48	2.44	1.88	2.43	2.68
Appreciation of diversity and multiculturality – Level	2.27	2.36	2.35	1.94	2.46	2.41
Ability to work in an international context – Level	2.34	2.4	2.31	2.35	2.51	2.41
Understanding of cultures and customs of other countries – Level	2	2.16	2	1.59	2.24	2.29
Ability to work autonomously – Level	2.87	2.75	2.93	2.71	2.95	2.76
Project design and management – Level	2.63	2.62	2.75	2.41	2.88	2.63
Initiative and entrepreneurial spirit – Level	2.39	2.36	2.49	2.18	2.43	2.66
Appreciation of ethical issues – Level	2.27	2.32	2.34	2.06	2.45	2.68
Concern for quality – Level	2.72	2.61	2.88	2.41	2.77	2.85
Will to succeed – Level	2.8	2.72	2.94	2.41	2.84	3.02
Patents and Intellectual Property Rights – Level	2.23	2.31	2.35	1.47	2.12	2.05
International Relations and Collaborations – Level	2.31	2.3	2.26	1.76	2.41	2.12

Table 8.7 Comparison of the gap of the generic competences across the stakeholders

Generic competence	Academic	Employer	Graduate	Student
Capacity for analysis and synthesis	0.37	0.32	0.51	0.41
Capacity for applying knowledge in practice	0.51	0.54	0.71	0.59
Planning and time management	0.67	0.56	0.76	0.57
Basic general technical knowledge of the profession of your work area	0.22	0.27	0.45	0.37
Grounding in basic knowledge of the profession of your work area	0.19	0.05	0.24	0.28
Oral and written communication in your native language	0.61	0.37	0.33	0.42
Knowledge of a second language	0.71	0.17	0.73	0.76
Elementary computing skills	0.22	0.1	0.25	0.28
Research skills	0.28	0.41	0.44	0.4
Capacity to learn	0.47	0.37	0.38	0.42
Information management skills	0.55	0.44	0.58	0.46
Critical and self-critical abilities	0.59	0.41	0.56	0.46
Capacity to adapt to new situations	0.68	0.46	0.73	0.63
Capacity for generating new ideas (creativity)	0.62	0.63	0.74	0.76
Problem solving	0.62	0.63	0.64	0.54
Decision making	0.61	0.59	0.67	0.6
Teamworking	0.55	0.76	0.56	0.5
Interpersonal skills	0.43	0.41	0.45	0.53
Leadership	0.47	0.29	0.74	0.69
Ability to work in an interdisciplinary team	0.66	0.39	0.72	0.64
Ability to communicate with non-experts (in the field)	0.66	0.46	0.76	0.56
Appreciation of diversity and multiculturality	0.38	0.1	0.35	0.42
Ability to work in an international context	0.51	0.37	0.8	0.75
Understanding of cultures and customs of other countries	0.38	0.15	0.47	0.52
Ability to work autonomously	0.57	0.54	0.44	0.43
Project design and management	0.5	0.39	0.54	0.51
Initiative and entrepreneurial spirit	0.69	0.56	0.58	0.63
Appreciation of ethical issues	0.49	0.29	0.35	0.44
Concern for quality	0.67	0.66	0.52	0.55
Will to succeed	0.45	0.32	0.45	0.59
Patents and Intellectual Property Rights	0.55	0.44	0.55	0.53
International Relations and Collaborations	0.43	0.34	0.72	0.61

Table 8.9 Comparison of importance of the specific competences across the stakeholders

Specific competence	Academic	Employer	Graduate	Student
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.48	3.31	3.36	3.18
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	3.19	3.17	3.11	2.98
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	3.3	3.28	3.05	3.05
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	3.03	2.97	2.79	2.83
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.78	3.06	2.87	2.84
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.43	3.36	3.35	3.27
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	3.38	3.36	3.2	3.09
8. Ability to apply a systems approach to engineering problems	3.42	3.31	3.26	3.15
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	3.14	3.11	3.15	2.99
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	3.11	3.33	3.13	3.13
11. Ability to identify and manage cost drivers in designs and projects	3.15	3.19	2.88	2.99
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	3.24	3.28	3.06	3.01
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	3.11	3.08	2.89	2.88
14. Ability to manage the design process and evaluate outcomes	3.24	3.17	2.87	2.93
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	3.07	3.06	2.72	2.79
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.97	2.81	2.76	2.76
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	3.04	3.11	2.65	2.89
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.9	2.72	2.53	2.79
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	3.1	3	2.67	2.81
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	3.1	3.06	2.84	2.87
21. Ability to demonstrate practical engineering skills	3.63	3.42	3.14	3.19
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	3.05	3.08	2.91	2.87
23. Ability to demonstrate understanding of the use of technical literature and other information sources	3.33	3.47	3.15	2.99
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.84	2.83	2.66	2.75
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	3.07	3.28	2.78	2.89
26. Ability to demonstrate awareness of quality issues	3.33	3.44	2.85	2.85
27. Ability to work with technical uncertainty	3.11	3.11	2.65	2.89
28. Ability to work in a group on a major project	3.48	3.36	3.29	3.25

Table 8.10 Comparison of level of development of the specific competences across the stakeholders

Specific competence	Academic	Employer	Graduate	Student
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.16	2.83	3.05	2.81
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2.97	2.92	3.07	2.86
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	2.84	2.69	2.54	2.57
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.56	2.5	2.39	2.41
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.31	2.33	2.19	2.32
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.22	2.97	3.04	2.85
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	3.04	2.58	2.91	2.71
8. Ability to apply a systems approach to engineering problems	2.91	2.72	2.88	2.68
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	2.51	2.44	2.47	2.46
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	2.64	2.67	2.44	2.47
11. Ability to identify and manage cost drivers in designs and projects	2.52	2.36	2.12	2.37
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2.74	2.67	2.42	2.41
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2.55	2.69	2.33	2.41
14. Ability to manage the design process and evaluate outcomes	2.71	2.47	2.24	2.43
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.55	2.5	2.14	2.25
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.48	2.36	2.07	2.29
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.44	2.44	2.15	2.33
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.31	2.33	2.04	2.26
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.47	2.64	2.33	2.34
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	2.84	2.61	2.39	2.45
21. Ability to demonstrate practical engineering skills	3.19	2.94	2.62	2.67
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2.65	2.72	2.48	2.45
23. Ability to demonstrate understanding of the use of technical literature and other information sources	2.97	3.19	2.85	2.61
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.2	2.36	2.15	2.3
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.4	2.56	2.27	2.44
26. Ability to demonstrate awareness of quality issues	2.76	2.67	2.32	2.47
27. Ability to work with technical uncertainty	2.67	2.56	2.31	2.48
28. Ability to work in a group on a major project	2.99	2.72	2.72	2.65

Table 8.11 Comparison of gap of the specific competences across the stakeholders

Specific competence	Academic	Employer	Graduate	Student
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.32	0.47	0.32	0.36
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	0.22	0.25	0.04	0.12
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	0.46	0.58	0.51	0.49
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	0.47	0.47	0.4	0.41
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	0.47	0.72	0.68	0.52
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.21	0.39	0.32	0.41
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.34	0.78	0.29	0.38
8. Ability to apply a systems approach to engineering problems	0.51	0.58	0.38	0.47
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	0.64	0.67	0.68	0.53
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.47	0.67	0.69	0.66
11. Ability to identify and manage cost drivers in designs and projects	0.64	0.83	0.76	0.62
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.5	0.61	0.64	0.6
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	0.56	0.39	0.56	0.47
14. Ability to manage the design process and evaluate outcomes	0.53	0.69	0.64	0.5
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	0.52	0.56	0.58	0.54
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	0.48	0.44	0.69	0.47
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.6	0.67	0.49	0.56
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	0.59	0.39	0.49	0.53
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.63	0.36	0.34	0.47
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	0.26	0.44	0.45	0.42
21. Ability to demonstrate practical engineering skills	0.44	0.47	0.52	0.52
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	0.41	0.36	0.42	0.41
23. Ability to demonstrate understanding of the use of technical literature and other information sources	0.36	0.28	0.31	0.38
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	0.64	0.47	0.51	0.45
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	0.67	0.72	0.51	0.45
26. Ability to demonstrate awareness of quality issues	0.57	0.78	0.53	0.39
27. Ability to work with technical uncertainty	0.44	0.56	0.34	0.42
28. Ability to work in a group on a major project	0.49	0.64	0.58	0.6

Table 8.13 Comparison of importance of the generic competences across the stakeholders (Masters level)

Generic competence	Academic	Employer	Graduate	Student
Capacity for analysis and synthesis – Importance	3.54	3.46	3.45	3.32
Capacity for applying knowledge in practice – Importance	3.61	3.71	3.49	3.45
Planning and time management – Importance	3.13	3.32	3.29	3.22
Basic general technical knowledge of the profession of your work area – Importance	3.51	3.49	3.28	3.23
Grounding in basic knowledge of the profession of your work area – Importance	3.36	3.17	3.15	3.11
Oral and written communication in your native language – Importance	3.33	3.51	3.17	3.16
Knowledge of a second language – Importance	3.3	3.2	3.2	3.38
Elementary computing skills – Importance	3.52	3.44	3.47	3.51
Research skills – Importance	2.87	2.8	3.1	2.95
Capacity to learn – Importance	3.55	3.63	3.42	3.36
Information management skills – Importance	3.46	3.41	3.41	3.34
Critical and self-critical abilities – Importance	3.04	3.1	2.97	3.04
Capacity to adapt to new situations – Importance	3.42	3.63	3.21	3.45
Capacity for generating new ideas (creativity) – Importance	3.21	3.27	3.31	3.47
Problem solving – Importance	3.57	3.73	3.53	3.57
Decision making – Importance	3.06	3.32	3.28	3.41
Teamworking – Importance	3.36	3.76	3.31	3.51
Interpersonal skills – Importance	2.95	3.34	2.99	3.2
Leadership – Importance	2.62	2.8	2.86	2.99
Ability to work in an interdisciplinary team – Importance	3.13	3.2	3.01	3.04
Ability to communicate with non-experts (in the field) – Importance	2.91	3.22	2.93	3.05
Appreciation of diversity and multiculturality – Importance	2.48	3.05	2.71	2.82
Ability to work in an international context – Importance	2.9	3.12	3.07	3.22
Understanding of cultures and customs of other countries – Importance	2.36	2.56	2.47	2.59
Ability to work autonomously – Importance	3.37	3.46	3.27	3.39
Project design and management – Importance	3.18	3.17	3.13	3.3
Initiative and entrepreneurial spirit – Importance	3.03	3.17	2.86	3.09
Appreciation of ethical issues – Importance	2.79	3.07	2.72	2.81
Concern for quality – Importance	3.37	3.73	3.27	3.35
Will to succeed – Importance	3.08	3.39	3.29	3.32
Patents and Intellectual Property Rights – Importance	2.64	2.73	2.83	2.9
International Relations and Collaborations – Importance	2.73	2.88	2.92	3.02

Table 8.14 Comparison of the level of development of the generic competences across the stakeholders (Masters level)

Generic competence	Academic	Employer	Graduate	Student
Capacity for analysis and synthesis – Level	3.1	2.8	3.13	2.94
Capacity for applying knowledge in practice – Level	3.06	2.8	3	2.73
Planning and time management – Level	2.52	2.39	2.63	2.63
Basic general technical knowledge of the profession of your work area – Level	3.04	2.95	3.01	2.94
Grounding in basic knowledge of the profession of your work area – Level	3.01	2.73	2.98	2.84
Oral and written communication in your native language – Level	2.69	3.15	2.92	2.8
Knowledge of a second language – Level	2.6	2.59	2.53	2.5
Elementary computing skills – Level	3.37	3.34	3.32	3.31
Research skills – Level	2.51	2.56	2.85	2.67
Capacity to learn – Level	2.94	3.2	3.18	3.09
Information management skills – Level	2.85	2.88	3.06	2.94
Critical and self-critical abilities – Level	2.43	2.54	2.69	2.59
Capacity to adapt to new situations – Level	2.82	2.78	2.78	2.84
Capacity for generating new ideas (creativity) – Level	2.6	2.73	2.69	2.75
Problem solving – Level	3.01	2.95	3.15	3.04
Decision making – Level	2.63	2.63	2.9	2.81
Teamworking – Level	2.9	3.05	3.12	3.03
Interpersonal skills – Level	2.55	2.76	2.66	2.68
Leadership – Level	2.15	2.17	2.38	2.33
Ability to work in an interdisciplinary team – Level	2.42	2.49	2.52	2.55
Ability to communicate with non-experts (in the field) – Level	2.31	2.51	2.45	2.48
Appreciation of diversity and multiculturality – Level	2.33	2.59	2.4	2.42
Ability to work in an international context – Level	2.45	2.56	2.37	2.39
Understanding of cultures and customs of other countries – Level	2.1	2.39	2.14	2.12
Ability to work autonomously – Level	2.96	2.71	3.01	3.12
Project design and management – Level	2.78	2.61	2.72	2.77
Initiative and entrepreneurial spirit – Level	2.37	2.46	2.39	2.49
Appreciation of ethical issues – Level	2.33	2.56	2.49	2.39
Concern for quality – Level	2.76	2.76	2.89	2.86
Will to succeed – Level	2.54	2.98	2.97	2.83
Patents and Intellectual Property Rights – Level	2.09	2.27	2.39	2.42
International Relations and Collaborations – Level	2.25	2.34	2.38	2.32

Table 8.17 Comparison of the gap of the generic competences across the stakeholders (Masters level)

Generic competence	Academic	Employer	Graduate	Student
Capacity for analysis and synthesis	0.43	0.66	0.32	0.38
Capacity for applying knowledge in practice	0.55	0.9	0.49	0.72
Planning and time management	0.61	0.93	0.66	0.59
Basic general technical knowledge of the profession of your work area	0.46	0.54	0.27	0.29
Grounding in basic knowledge of the profession of your work area	0.34	0.44	0.17	0.27
Oral and written communication in your native language	0.64	0.37	0.24	0.36
Knowledge of a second language	0.7	0.61	0.67	0.88
Elementary computing skills	0.15	0.1	0.15	0.2
Research skills	0.36	0.24	0.25	0.28
Capacity to learn	0.61	0.44	0.24	0.27
Information management skills	0.61	0.54	0.35	0.4
Critical and self-critical abilities	0.61	0.56	0.28	0.45
Capacity to adapt to new situations	0.6	0.85	0.43	0.61
Capacity for generating new ideas (creativity)	0.61	0.54	0.61	0.72
Problem solving	0.55	0.78	0.38	0.53
Decision making	0.43	0.68	0.38	0.6
Teamworking	0.46	0.71	0.18	0.48
Interpersonal skills	0.41	0.59	0.33	0.52
Leadership	0.47	0.63	0.49	0.66
Ability to work in an interdisciplinary team	0.72	0.71	0.5	0.49
Ability to communicate with non-experts (in the field)	0.6	0.71	0.49	0.57
Appreciation of diversity and multiculturality	0.15	0.46	0.31	0.41
Ability to work in an international context	0.45	0.56	0.7	0.83
Understanding of cultures and customs of other countries	0.25	0.17	0.33	0.47
Ability to work autonomously	0.42	0.76	0.25	0.27
Project design and management	0.4	0.56	0.41	0.53
Initiative and entrepreneurial spirit	0.66	0.71	0.47	0.61
Appreciation of ethical issues	0.46	0.51	0.24	0.42
Concern for quality	0.61	0.98	0.38	0.49
Will to succeed	0.54	0.41	0.32	0.48
Patents and Intellectual Property Rights	0.55	0.46	0.44	0.48
International Relations and Collaborations	0.48	0.54	0.55	0.7

Table 8.19 Comparison of the importance of the specific competences across the stakeholders (Masters level)

Specific competence	Academic	Employer	Graduate	Student
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.45	3.13	3.35	3.26
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	3.13	2.8	3.07	3.03
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	3.18	3.13	3.11	3.09
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	3.06	2.8	2.92	2.86
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.84	2.93	2.78	2.91
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.51	3.03	3.34	3.37
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	3.29	2.87	3.07	3.09
8. Ability to apply a systems approach to engineering problems	3.54	3.13	3.1	3.23
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	3.1	3.03	2.98	3
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	3.06	3.2	3.09	3.25
11. Ability to identify and manage cost drivers in designs and projects	3.13	3.07	2.91	3.1
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	3.3	3.1	3.06	3.19
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	3.06	2.9	2.83	2.98
14. Ability to manage the design process and evaluate outcomes	3.25	2.7	2.93	3.08
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.85	2.9	2.81	2.93
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.91	2.93	2.73	2.92
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.91	2.8	2.87	3
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.66	2.87	2.68	2.89
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.88	2.8	2.72	2.92
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	3.15	3.07	2.98	3.02
21. Ability to demonstrate practical engineering skills	3.55	3.03	3.18	3.35
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	3.03	3.13	3	3.1
23. Ability to demonstrate understanding of the use of technical literature and other information sources	3.39	3.03	3.28	3.17
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.78	2.67	2.81	2.86
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.98	2.87	2.94	3.04
26. Ability to demonstrate awareness of quality issues	3.27	3.23	3.03	2.89
27. Ability to work with technical uncertainty	3.12	2.97	2.96	3.05
28. Ability to work in a group on a major project	3.42	3.13	3.35	3.42

Table 8.20 Comparison of the level of development of the specific competences across the stakeholders (Masters level)

Specific competence	Academic	Employer	Graduate	Student
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	3.01	2.97	3.23	2.96
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	2.64	2.7	3.13	3.01
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	2.6	2.6	2.74	2.62
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	2.34	2.53	2.62	2.51
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	2.34	2.53	2.33	2.36
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	3.07	2.73	3.04	2.97
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	2.85	2.6	2.84	2.76
8. Ability to apply a systems approach to engineering problems	2.76	2.6	2.77	2.77
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	2.51	2.47	2.68	2.52
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	2.36	2.47	2.63	2.56
11. Ability to identify and manage cost drivers in designs and projects	2.46	2.03	2.38	2.4
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	2.6	2.5	2.61	2.56
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	2.36	2.23	2.43	2.45
14. Ability to manage the design process and evaluate outcomes	2.6	2.1	2.56	2.54
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	2.27	2.37	2.38	2.4
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	2.39	2.37	2.31	2.37
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	2.32	2.17	2.41	2.44
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	2.09	2.07	2.22	2.24
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	2.31	2.47	2.43	2.45
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	2.82	2.37	2.65	2.63
21. Ability to demonstrate practical engineering skills	3.01	2.57	2.86	2.78
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	2.54	2.33	2.74	2.68
23. Ability to demonstrate understanding of the use of technical literature and other information sources	2.91	2.8	3.02	2.82
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	2.22	2.2	2.46	2.42
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	2.36	2.2	2.5	2.5
26. Ability to demonstrate awareness of quality issues	2.61	2.6	2.58	2.55
27. Ability to work with technical uncertainty	2.6	2.43	2.67	2.61
28. Ability to work in a group on a major project	2.85	2.47	3	2.82

Table 8.21 Comparison of the gap of the specific competences across the stakeholders (Masters level)

Specific competence	Academic	Employer	Graduate	Student
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	0.43	0.17	0.12	0.3
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	0.49	0.1	-0.06	0.03
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	0.58	0.53	0.36	0.47
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	0.72	0.27	0.3	0.35
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	0.49	0.4	0.45	0.54
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	0.43	0.3	0.29	0.4
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	0.44	0.27	0.23	0.33
8. Ability to apply a systems approach to engineering problems	0.78	0.53	0.33	0.47
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	0.6	0.57	0.3	0.48
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	0.7	0.73	0.46	0.7
11. Ability to identify and manage cost drivers in designs and projects	0.67	1.03	0.53	0.7
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	0.7	0.6	0.45	0.63
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	0.7	0.67	0.4	0.53
14. Ability to manage the design process and evaluate outcomes	0.66	0.6	0.37	0.54
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	0.58	0.53	0.42	0.53
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	0.52	0.57	0.42	0.55
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	0.59	0.63	0.46	0.56
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	0.57	0.8	0.45	0.65
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	0.57	0.33	0.29	0.47
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products.	0.33	0.7	0.33	0.38
21. Ability to demonstrate practical engineering skills	0.54	0.47	0.32	0.57
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.)	0.49	0.8	0.26	0.42
23. Ability to demonstrate understanding of the use of technical literature and other information sources	0.48	0.23	0.26	0.35
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	0.55	0.47	0.35	0.44
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	0.62	0.67	0.44	0.54
26. Ability to demonstrate awareness of quality issues	0.66	0.63	0.45	0.34
27. Ability to work with technical uncertainty	0.52	0.53	0.29	0.44
28. Ability to work in a group on a major project	0.57	0.67	0.35	0.59

Appendix 2 – Questionnaires

EIE-Surveyor Student Questionnaire

We are asking you to participate in a study into the competencies required for success in future careers. The methodology being used follows that of the Tuning Project, an EU funded project which established an approach to comparing the perception of the importance of generic and specific skills, and how well they are developed. The study asks similar questions of students, academics, graduates and employers to establish a statistical dataset which is then used to make comparisons. In this questionnaire the questions asked deal with your perception of the importance of competences to you and your perception of the level to which these are developed within the degree programme you are currently studying at your institution. The information it provides is very valuable in helping to improve planning for future students. The following questionnaire should take around 10 minutes to complete.

Participation in this study is voluntary and you have the right not to answer any question or item, or to withdraw your consent and terminate participation at any time.

The research is supported by the EIE-Surveyor Project, an EU funded project that includes partner institutions across the whole of Europe.

No personal identifier information is requested so your response to this questionnaire cannot be connected with you personally in any way. We will ensure the confidentiality of all information provided in your response.

****

By continuing, I agree to participate voluntarily in this survey. I understand the research purpose of the survey and the protection that will be given to any information I provide. I understand that any information provided by me will remain confidential with regard to my identity. I also understand that by participating in this study I am not waiving any of my legal rights.

I have been informed that I may contact Tony Ward, Department of Electronics, University of York, Heslington, York, YO10 5DD if I have questions or comments about this survey.

Please read the instructions for each of the following questions. Review the response options carefully before you mark your answers. There are no right or wrong answers. Answer the questions as quickly and honestly as possible. Please answer all the questions in the questionnaire.

Questionnaire code = S

Background Information

1. Name of the educational institution: . . . . . .

2. In what Country is your institution?

Tick	Country	Tick	Country
	1. Austria		17. Liechtenstein
	2. Belgium		18. Lithuania
	3. Bulgaria		19. Luxembourg
	4. Cyprus		20. Malta
	5. Czech Republic		21. Netherlands
	6. Denmark		22. Norway
	7. Estonia		23. Poland
	8. Finland		24. Portugal
	9. France		25. Romania
	10. Germany		26. Slovak Republic
	11. Greece		27. Slovenia
	12. Hungary		28. Spain
	13. Iceland		29. Sweden
	14. Ireland		30. Turkey
	15. Italy		31. United Kingdom
	16. Latvia		

Other (please specify) ……

3. What is your Sex/Gender?:

Male 1. ☐
Female 2. ☐

4. What is your age?

20 or under 1. ☐
21 – 30 2. ☐
31 – 40 3. ☐
41 – 50 4. ☐
51 – 60 5. ☐
over 61 6. ☐

5. What is the title of the academic programme you are studying for?: . . . . . .

6. What 'level' is the degree you are studying?

Bachelor 1. ☐
Masters 2. ☐
Doctoral/PhD 3. ☐

Other 4. ☐

(please specify) ……..

7. What academic year of study are you currently in? (Please circle only one)

1 2 3 4 5 6 Other …..

8. What is the standard (or nominal) length of your degree programme? (Please circle only one)

1 2 3 4 5 6 Other …..

9. Do you feel that the degree programme is preparing you adequately for employment? (Please circle only one)

Very much	Much	Some	Little	Very little
1	2	3	4	5

10. How would you rate the employment potential of your degree? (Please circle only one)

Very poor	Poor	Fair	Good	Very good
1	2	3	4	5

Generic Competences Question

For each of the generic competences listed below, please estimate:

—the **importance** of the competence, in your opinion, for work you would expect to get when you successfully completed your degree programme;
—the **level** to which each competence is developed by the degree programme you are taking at your university.

The blank spaces may be used to indicate any other competences that you consider important but which do not appear in the list.

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

Competence	Importance to work you expect to get	Level to which competence is being developed
1.Capacity for analysis and synthesis	1 2 3 4	1 2 3 4
2.Capacity for applying knowledge in practice	1 2 3 4	1 2 3 4
3.Planning and time management	1 2 3 4	1 2 3 4
4. Basic general technical knowledge of the profession of your work area	1 2 3 4	1 2 3 4
5.Grounding in basic knowledge of the profession of your work area	1 2 3 4	1 2 3 4
6.Oral and written communication in your native language	1 2 3 4	1 2 3 4
7.Knowledge of a second language	1 2 3 4	1 2 3 4
8.Elementary computing skills	1 2 3 4	1 2 3 4
9.Research skills	1 2 3 4	1 2 3 4
10.Capacity to learn	1 2 3 4	1 2 3 4
11.Information management skills (ability to retrieve and analyse information from different sources)	1 2 3 4	1 2 3 4
12.Critical and self-critical abilities	1 2 3 4	1 2 3 4
13.Capacity to adapt to new situations	1 2 3 4	1 2 3 4
14.Capacity for generating new ideas (creativity)	1 2 3 4	1 2 3 4
15.Problem solving	1 2 3 4	1 2 3 4
16.Decision-making	1 2 3 4	1 2 3 4
17.Teamworking	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Competence	Importance to work you expect to get	Level to which competence is being developed
18.Interpersonal skills	1 2 3 4	1 2 3 4
19.Leadership	1 2 3 4	1 2 3 4
20.Ability to work in an interdisciplinary team	1 2 3 4	1 2 3 4
21.Ability to communicate with non-experts (in the field)	1 2 3 4	1 2 3 4
22.Appreciation of diversity and multiculturality	1 2 3 4	1 2 3 4
23.Ability to work in an international context	1 2 3 4	1 2 3 4
24.Understanding of cultures and customs of other countries	1 2 3 4	1 2 3 4
25.Ability to work autonomously	1 2 3 4	1 2 3 4
26.Project design and management	1 2 3 4	1 2 3 4
27.Initiative and entrepreneurial spirit	1 2 3 4	1 2 3 4
28.Appreciation of ethical issues	1 2 3 4	1 2 3 4
29.Concern for quality	1 2 3 4	1 2 3 4
30.Will to succeed	1 2 3 4	1 2 3 4
31. Patents and Intellectual Property Rights	1 2 3 4	1 2 3 4
32. International Relations and Collaborations	1 2 3 4	1 2 3 4
33.	1 2 3 4	1 2 3 4
34.	1 2 3 4	1 2 3 4

Please rank below the five most important competences according to your opinion. Please write the number of the item within the box. Mark on the first box the most important, on the second box the second most important and so on.

1	Item number	
2	Item number	
3	Item number	
4	Item number	
5	Item number	

Ability in Languages other than Native Language

For each of the languages listed below, please estimate:

—the **importance** of being able to communicate effectively verbally and in written form, in your opinion, for work you would expect to get when you successfully completed your degree programme
— the **level** to which each competence is developed by the degree you are taking at your university

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

	Importance								Level of development as a compulsory part of your degree programme							
Language	Written				Spoken				Written				Spoken			
Bulgarian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Czech	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Danish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Dutch	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
English	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Estonian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Finnish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
French	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
German	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Greek	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Hungarian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Icelandic	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Irish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Italian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Latvian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Lithuanian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Maltese	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Norwegian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Polish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Portuguese	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Romanian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Slovak	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Slovene	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Spanish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Swedish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Turkish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

Specific Competences Question

For each of the competences listed below, please estimate:

—the **importance** of the competence, in your opinion, for work you would expect to get when you successfully completed your degree programme;
— the **level** to which each competence is developed by the degree programme you are taking at your university.

The blank spaces may be used to indicate any other competences that you consider important but which do not appear in the list.

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

Competence	Importance to work you expect to get	Level to which competence is being developed
Fundamentals		
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	1 2 3 4	1 2 3 4
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	1 2 3 4	1 2 3 4
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	1 2 3 4	1 2 3 4
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	1 2 3 4	1 2 3 4
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Competence	Importance to work you expect to get	Level to which competence is being developed
Engineering Analysis		
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	1 2 3 4	1 2 3 4
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	1 2 3 4	1 2 3 4
8. Ability to apply a systems approach to engineering problems	1 2 3 4	1 2 3 4
Design		
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	1 2 3 4	1 2 3 4
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	1 2 3 4	1 2 3 4
11. Ability to identify and manage cost drivers in designs and projects	1 2 3 4	1 2 3 4
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	1 2 3 4	1 2 3 4
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	1 2 3 4	1 2 3 4
14. Ability to manage the design process and evaluate outcomes	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Competence	Importance to work you expect to get	Level to which competence is being developed
Economic, social and environmental context		
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	1 2 3 4	1 2 3 4
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	1 2 3 4	1 2 3 4
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	1 2 3 4	1 2 3 4
18. Ability to demonstrate awareness of the legal framework relevant to engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	1 2 3 4	1 2 3 4
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	1 2 3 4	1 2 3 4
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products	1 2 3 4	1 2 3 4
21. Ability to demonstrate practical engineering skills.	1 2 3 4	1 2 3 4
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc)	1 2 3 4	1 2 3 4
23. Ability to demonstrate understanding of the use of technical literature and other information sources	1 2 3 4	1 2 3 4
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Competence	Importance to work you expect to get	Level to which competence is being developed
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	1 2 3 4	1 2 3 4
26. Ability to demonstrate awareness of quality issues	1 2 3 4	1 2 3 4
27. Ability to work with technical uncertainty	1 2 3 4	1 2 3 4
28. Ability to work in a group on a major project	1 2 3 4	1 2 3 4
29.	1 2 3 4	1 2 3 4
30.	1 2 3 4	1 2 3 4
31.	1 2 3 4	1 2 3 4
32.	1 2 3 4	1 2 3 4
33.	1 2 3 4	1 2 3 4
34.	1 2 3 4	1 2 3 4

Please rank below the five most important competences according to your opinion. Please write the number of the item within the box. Mark on the first box the most important, on the second box the second most important and so on.

1	Item number	
2	Item number	
3	Item number	
4	Item number	
5	Item number	

Many thanks for your co-operation

EIE-Surveyor Academics Questionnaire

We are asking you to participate in a study into the skills and competencies required for success in future careers. The methodology being used follows that of the Tuning Project, an EU funded project which established an approach to comparing the perception of the importance of generic and specific skills, and how well they are developed. The study asks similar questions of students, academics, graduates and employers to establish a statistical dataset which is then used to make comparisons. In this questionnaire the questions asked deal with your perception of the importance of skills and competences to you and your perception of the level to which these are developed within the degree programmes at your institution.

Participation in this study is voluntary and you have the right not to answer any question or item, or to withdraw your consent and terminate participation at any time.

The research is supported by the EIE-Surveyor Project, an EU funded project that includes partner institutions across the whole of Europe.

No personal identifier information is requested so your response to this questionnaire cannot be connected with you personally in any way. We will ensure the confidentiality of all information provided in your response.

****

By continuing, I agree to participate voluntarily in this survey. I understand the research purpose of the survey and the protection that will be given to any information I provide. I understand that any information provided by me will remain confidential with regard to my identity. I also understand that by participating in this study I am not waiving any of my legal rights.

I have been informed that I may contact Tony Ward, Department of Electronics, University of York, Heslington, York, YO10 5DD, email aew6@york.ac.uk if I have questions or comments about this survey.

Please read the instructions for each of the following questions. Review the response options carefully before you mark your answers. There are no right or wrong answers. Answer the questions as quickly and honestly as possible. Please answer all the questions in the questionnaire.

Please complete this questionnaire for a specific academic programme. If you would like to provide a response for more than one academic programme please complete a separate questionnaire for each.

Questionnaire code = A

Background Information

1. Name of the educational institution: . . . . . .

2. Your position within the institution: (Please tick the first position in the list that best describes you. Please tick only **ONE** position)

Tick	Your Position
	17. Head of Institution
	18. Head of Faculty
	19. Head of Department
	20. Professor (Teaching)
	21. Senior Academic (Teaching)
	22. Junior Academic (Teaching)
	23. Administrator associated with academic activities
	24. Technical staff member associated with academic activities
	25. Other, please specify : ……

2a. Are you responsible for the academic design of the degree programme or a module within the degree programme?

1.Yes ☐ 2.No ☐

3. In what Country is your institution? (Please tick only one)

Tick	Country	Tick	Country
	1. Austria		32. Liechtenstein
	2. Belgium		33. Lithuania
	3. Bulgaria		34. Luxembourg
	4. Cyprus		35. Malta
	5. Czech Republic		36. Netherlands
	6. Denmark		37. Norway
	7. Estonia		38. Poland
	8. Finland		39. Portugal
	9. France		40. Romania
	10. Germany		41. Slovak Republic
	11. Greece		42. Slovenia
	12. Hungary		43. Spain
	13. Iceland		44. Sweden
	14. Ireland		45. Turkey
	15. Italy		46. United Kingdom
	16. Latvia		

Other (please specify) ……

4. What is your Sex/Gender?:

Male 1. ☐

Female 2. ☐

5. What is your age?

20 or under	1. ☐
21 – 30	2. ☐
31 – 40	3. ☐
41 – 50	4. ☐
51 – 60	5. ☐
over 61	6. ☐

6. What is the specific name of the academic programme for which you are completing this questionnaire?

. . . . . .

6a. What 'level' is the academic degree programme you are completing this questionnaire for?

Bachelor	1. ☐
Masters	2. ☐
Doctoral/PhD	3. ☐
Other	4. ☐

(please specify) ……..

7. Approximately how many students enrolled in this academic programme this year?

. . . . . .

8. Do you consider that university is preparing your students adequately for employment?

(Please circle one number)

Very much	Much	Some	Little	Very little
1	2	3	4	5

Generic Skills Question

For each of the generic skills listed below, please estimate:

—the **importance** of the skill or competence, in your opinion, for work you would expect your graduates to get having successfully completed your degree programme;
—the **level** to which each skill or competence is developed by your degree programme at your university.

The blank spaces may be used to indicate any other skills that you consider important but which do not appear in the list.

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

Skill/Competence	Importance for your graduates	Level to which skill is developed in your degree programme
1.Capacity for analysis and synthesis	1 2 3 4	1 2 3 4
2.Capacity for applying knowledge in practice	1 2 3 4	1 2 3 4
3.Planning and time management	1 2 3 4	1 2 3 4
4. Basic general technical knowledge of the profession of your work area	1 2 3 4	1 2 3 4
5.Grounding in basic knowledge of the profession of your work area	1 2 3 4	1 2 3 4
6.Oral and written communication in your native language	1 2 3 4	1 2 3 4
7.Knowledge of a second language	1 2 3 4	1 2 3 4
8.Elementary computing skills	1 2 3 4	1 2 3 4
9.Research skills	1 2 3 4	1 2 3 4
10.Capacity to learn	1 2 3 4	1 2 3 4
11.Information management skills (ability to retrieve and analyse information from different sources)	1 2 3 4	1 2 3 4
12.Critical and self-critical abilities	1 2 3 4	1 2 3 4
13.Capacity to adapt to new situations	1 2 3 4	1 2 3 4
14.Capacity for generating new ideas (creativity)	1 2 3 4	1 2 3 4
15.Problem solving	1 2 3 4	1 2 3 4
16.Decision-making	1 2 3 4	1 2 3 4
17.Teamworking	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance for your graduates	Level to which skill is developed in your degree programme
18.Interpersonal skills	1 2 3 4	1 2 3 4
19.Leadership	1 2 3 4	1 2 3 4
20.Ability to work in an interdisciplinary team	1 2 3 4	1 2 3 4
21.Ability to communicate with non-experts (in the field)	1 2 3 4	1 2 3 4
22.Appreciation of diversity and multiculturality	1 2 3 4	1 2 3 4
23.Ability to work in an international context	1 2 3 4	1 2 3 4
24.Understanding of cultures and customs of other countries	1 2 3 4	1 2 3 4
25.Ability to work autonomously	1 2 3 4	1 2 3 4
26.Project design and management	1 2 3 4	1 2 3 4
27.Initiative and entrepreneurial spirit	1 2 3 4	1 2 3 4
28.Appreciation of ethical issues	1 2 3 4	1 2 3 4
29.Concern for quality	1 2 3 4	1 2 3 4
30.Will to succeed	1 2 3 4	1 2 3 4
31. Patents and Intellectual Property Rights	1 2 3 4	1 2 3 4
32. International Relations and Collaborations	1 2 3 4	1 2 3 4
33.	1 2 3 4	1 2 3 4
34.	1 2 3 4	1 2 3 4

Please rank below the five most important competences according to your opinion. Please write the number of the item within the box. Mark on the first box the most important, on the second box the second most important and so on.

1	Item number	
2	Item number	
3	Item number	
4	Item number	
5	Item number	

Ability in Languages other than Native Language

For each of the languages listed below, please estimate:

—the **importance** of being able to communicate effectively verbally and in written form, in your opinion, for work you would expect your graduates to get having successfully completed your degree programme;
—the **level** to which ability is typically developed by your graduates as a compulsory part of your degree programme.

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

	Importance								Level of development as a compulsory part of your degree programme							
Language	Written				Spoken				Written				Spoken			
1. Bulgarian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
2. Czech	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
3. Danish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
4. Dutch	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
5. English	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
6. Estonian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
7. Finnish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
8. French	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
9. German	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
10. Greek	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
11. Hungarian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
12. Icelandic	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
13. Irish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
14. Italian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
15. Latvian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
16. Lithuanian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
17. Maltese	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
18. Norwegian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
19. Polish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
20. Portuguese	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
21. Romanian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
22. Slovak	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
23. Slovene	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
24. Spanish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
25. Swedish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
26. Turkish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
27.	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
28.	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

Specific Skills Question

For each of the skills listed below, please estimate:

—the **importance** of the skill or competence, in your opinion, for work you would expect your graduates to get having successfully completed your degree programme;
—the **level** to which each skill or competence has been developed as demonstrated by the graduates you have recruited over the past three years to this work area.

The blank spaces may be used to indicate any other skills that you consider important but which do not appear in the list.

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

Skill/Competence	Importance for your graduates	Level to which skill is developed in your degree programme
Fundamentals		
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline	1 2 3 4	1 2 3 4
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline	1 2 3 4	1 2 3 4
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines	1 2 3 4	1 2 3 4
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	1 2 3 4	1 2 3 4
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance for your graduates	Level to which skill is developed in your degree programme
Engineering Analysis		
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve engineering problems	1 2 3 4	1 2 3 4
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques	1 2 3 4	1 2 3 4
8. Ability to apply a systems approach to engineering problems	1 2 3 4	1 2 3 4
Design		
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	1 2 3 4	1 2 3 4
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	1 2 3 4	1 2 3 4
11. Ability to identify and manage cost drivers in designs and projects	1 2 3 4	1 2 3 4
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	1 2 3 4	1 2 3 4
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	1 2 3 4	1 2 3 4
14. Ability to manage the design process and evaluate outcomes	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance for your graduates	Level to which skill is developed in your degree programme
Economic, social and environmental context		
15. Ability to demonstrate knowledge and understanding of the commercial and economic context	1 2 3 4	1 2 3 4
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context	1 2 3 4	1 2 3 4
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	1 2 3 4	1 2 3 4
18. Ability to demonstrate awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	1 2 3 4	1 2 3 4
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	1 2 3 4	1 2 3 4
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products	1 2 3 4	1 2 3 4
21. Ability to demonstrate practical engineering skills.	1 2 3 4	1 2 3 4
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc)	1 2 3 4	1 2 3 4
23. Ability to demonstrate understanding of the use of technical literature and other information sources	1 2 3 4	1 2 3 4
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance for your graduates	Level to which skill is developed in your degree
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	1 2 3 4	1 2 3 4
26. Ability to demonstrate awareness of quality issues	1 2 3 4	1 2 3 4
27. Ability to work with technical uncertainty	1 2 3 4	1 2 3 4
28. Ability to work in a group on a major project	1 2 3 4	1 2 3 4
29.	1 2 3 4	1 2 3 4
30.	1 2 3 4	1 2 3 4
31.	1 2 3 4	1 2 3 4
32.	1 2 3 4	1 2 3 4
33.	1 2 3 4	1 2 3 4
34.	1 2 3 4	1 2 3 4

Please rank below the five most important competences according to your opinion. Please write the number of the item within the box. Mark on the first box the most important, on the second box the second most important and so on.

1	Item number	
2	Item number	
3	Item number	
4	Item number	
5	Item number	

Many thanks for your co-operation

EIE-Surveyor Graduates Questionnaire

We are asking you to participate in a study into the skills and competencies of the graduates of Higher Education programmes. We are particularly interested in how well the degree programme(s) you took prepared you for the work you are currently undertaking. The methodology being used follows that of the Tuning Project, an EU funded project which established an approach to comparing the perception of the importance of generic and specific skills, and how well they are developed. The study asks similar questions of students, academics, graduates and employers to establish a statistical dataset which is then used to make comparisons. In this questionnaire the questions asked deal with your perception of the importance of skills and competences to you and your perception of the level to which these were developed in your degree programme. The information it provides is very valuable in helping to improve course planning for future students. The following questionnaire should take around 10 minutes to complete.

Participation in this study is voluntary and you have the right not to answer any question or item, or to withdraw your consent and terminate participation at any time.

The research is supported by the EIE-Surveyor Project, an EU funded project that includes 115 partner institutions across the whole of Europe.

No personal identifier information is requested so your response to this questionnaire cannot be connected with you personally in any way. We will ensure the confidentiality of all information provided in your response.

****

By continuing, I agree to participate voluntarily in this survey. I understand the research purpose of the survey and the protection that will be given to any information I provide. I understand that any information provided by me will remain confidential with regard to my identity. I also understand that by participating in this study I am not waiving any of my legal rights.

I have been informed that I may contact Tony Ward, Department of Electronics, University of York, Heslington, York, YO10 5DD, email: aew6@york.ac.uk if I have questions or comments about this survey.

Please read the instructions for each of the following questions. Review the response options carefully before you mark your answers. There are no right or wrong answers. Answer the questions as quickly and honestly as possible. Please answer all the questions in the questionnaire.

Questionnaire code = G

Background Information

1. Name of the organization in which you work: . . . . . .

2. Your position within the organization: (Please tick the first position in the list that best describes you. Please tick only **ONE** position)

Tick	Your Position
	26. Head of the organization
	27. Member of the Management Team
	28. Head of Department
	29. Head of Group or Section
	30. Manager
	31. Supervisor
	32. Engineer
	33. Worker
	34. Other, please specify : ……

2a. Number of employees in your organization: . . . . . .

2b. Are you directly involved in the recruitment of graduates? 1.Yes ☐ 2.No ☐

2c. Are you directly involved in the supervision of graduates? 1.Yes ☐ 2.No ☐

3. In what Country are you working (in alphabetical order)?

Tick	Country	Tick	Country
	1. Austria		17. Liechtenstein
	2. Belgium		18. Lithuania
	3. Bulgaria		19. Luxembourg
	4. Cyprus		20. Malta
	5. Czech Republic		21. Netherlands
	6. Denmark		22. Norway
	7. Estonia		23. Poland
	8. Finland		24. Portugal
	9. France		25. Romania
	10. Germany		26. Slovak Republic
	11. Greece		27. Slovenia
	12. Hungary		28. Spain
	13. Iceland		29. Sweden
	14. Ireland		30. Turkey
	15. Italy		31. United Kingdom
	16. Latvia		

Other (please specify) ……

4. What is your Sex/Gender?:

Male 1. ☐
Female 2. ☐

5. What is your age?

20 or under 1. ☐
21 – 30 2. ☐
31 – 40 3. ☐
41 – 50 4. ☐
51 – 60 5. ☐
over 61 6. ☐

6. What is the name of the educational institution at which you studied for your highest qualification?

. . . . . .

7. In what Country did you study for your highest qualification?

Tick	Country	Tick	Country
	1. Austria		17. Liechtenstein
	2. Belgium		18. Lithuania
	3. Bulgaria		19. Luxembourg
	4. Cyprus		20. Malta
	5. Czech Republic		21. Netherlands
	6. Denmark		22. Norway
	7. Estonia		23. Poland
	8. Finland		24. Portugal
	9. France		25. Romania
	10. Germany		26. Slovak Republic
	11. Greece		27. Slovenia
	12. Hungary		28. Spain
	13. Iceland		29. Sweden
	14. Ireland		30. Turkey
	15. Italy		31. United Kingdom
	16. Latvia		

Other (please specify) ……

8. What is the title of the highest qualification you studied?:

. . . . . .

8a. What ‘level’ is that qualification?

Bachelor	1. ☐
Masters	2. ☐
Doctoral/PhD	3. ☐
Other	4. ☐

(please specify) ……..

9. What is the specific work area in which you work?

. . . . . .

10. Do you consider that university has given you adequate preparation for working in this work area in your company?

(Please circle one number)

Very much	Much	Some	Little	Very little
1	2	3	4	5

Generic Skills Question

For each of the skills listed below, please estimate:

—the **importance** of the skill or competence, in your opinion, for carrying out work in the area of your employment work within your organisation;
—the **level** to which each skill or competence was developed as part of the degree programme(s) you have taken.

The blank spaces may be used to indicate any other skills that you consider important but which do not appear in the list.

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

Skill/Competence	Importance in your work area	Level to which skill was developed by your degree programme
1.Capacity for analysis and synthesis	1 2 3 4	1 2 3 4
2.Capacity for applying knowledge in practice	1 2 3 4	1 2 3 4
3.Planning and time management	1 2 3 4	1 2 3 4
4. Basic general technical knowledge of the profession of your work area	1 2 3 4	1 2 3 4
5.Grounding in basic knowledge of the profession of your work area	1 2 3 4	1 2 3 4
6.Oral and written communication in your native language	1 2 3 4	1 2 3 4
7.Knowledge of a second language	1 2 3 4	1 2 3 4
8.Elementary computing skills	1 2 3 4	1 2 3 4
9.Research skills	1 2 3 4	1 2 3 4
10.Capacity to learn	1 2 3 4	1 2 3 4
11.Information management skills (ability to retrieve and analyse information from different sources)	1 2 3 4	1 2 3 4
12.Critical and self-critical abilities	1 2 3 4	1 2 3 4
13.Capacity to adapt to new situations	1 2 3 4	1 2 3 4
14.Capacity for generating new ideas (creativity)	1 2 3 4	1 2 3 4
15.Problem solving	1 2 3 4	1 2 3 4
16.Decision-making	1 2 3 4	1 2 3 4
17.Teamworking	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance in your work area	Level to which skill was developed by your degree programme
18.Interpersonal skills	1 2 3 4	1 2 3 4
19.Leadership	1 2 3 4	1 2 3 4
20.Ability to work in an interdisciplinary team	1 2 3 4	1 2 3 4
21.Ability to communicate with non-experts (in the field)	1 2 3 4	1 2 3 4
22.Appreciation of diversity and multiculturality	1 2 3 4	1 2 3 4
23.Ability to work in an international context	1 2 3 4	1 2 3 4
24.Understanding of cultures and customs of other countries	1 2 3 4	1 2 3 4
25.Ability to work autonomously	1 2 3 4	1 2 3 4
26.Project design and management	1 2 3 4	1 2 3 4
27.Initiative and entrepreneurial spirit	1 2 3 4	1 2 3 4
28.Appreciation of ethical issues	1 2 3 4	1 2 3 4
29.Concern for quality	1 2 3 4	1 2 3 4
30.Will to succeed	1 2 3 4	1 2 3 4
31. Patents and Intellectual Property Rights	1 2 3 4	1 2 3 4
32. International Relations and Collaborations	1 2 3 4	1 2 3 4
33. Professional Ethics	1 2 3 4	1 2 3 4
34.	1 2 3 4	1 2 3 4

Please rank below the five most important competences according to your opinion. Please write the number of the item within the box. Mark on the first box the most important, on the second box the second most important and so on.

1	Item number	
2	Item number	
3	Item number	
4	Item number	
5	Item number	

Ability in Languages other than Native Language

For each of the languages listed below, please estimate:

—the **importance** of being able to communicate effectively verbally and in written form, in your opinion, for carrying out work in the area of your work in your professional employment in your organisation;
—the **level** to which ability was developed as a compulsory part of your degree programme.

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

	Importance								Level of development as a compulsory part of your degree programme							
Language	Written				Spoken				Written				Spoken			
Bulgarian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Czech	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Danish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Dutch	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
English	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Estonian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Finnish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
French	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
German	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Greek	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Hungarian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Icelandic	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Irish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Italian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Latvian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Lithuanian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Maltese	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Norwegian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Polish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Portuguese	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Romanian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Slovak	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Slovene	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Spanish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Swedish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Turkish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

Specific Skills Question

For each of the skills listed below, please estimate:

—the **importance** of the skill or competence, in your opinion, for work in your professional employment in your organisation;
—the **level** to which each skill or competence was developed as part of the degree programme(s) you have taken.

The blank spaces may be used to indicate any other skills that you consider important but which do not appear in the list.

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

Skill/Competence	Importance in your work area	Level to which skill was developed by your degree programme
Fundamentals		
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline of the work area	1 2 3 4	1 2 3 4
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline of the work area	1 2 3 4	1 2 3 4
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines appropriate to the work area	1 2 3 4	1 2 3 4
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	1 2 3 4	1 2 3 4
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement in the work area	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance in your work area	Level to which skill was developed by your degree programme
Engineering Analysis		
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve problems in the work area	1 2 3 4	1 2 3 4
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques in the work area	1 2 3 4	1 2 3 4
8. Ability to apply a systems approach to engineering problems in the work area	1 2 3 4	1 2 3 4
Design		
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	1 2 3 4	1 2 3 4
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	1 2 3 4	1 2 3 4
11. Ability to identify and manage cost drivers in designs and projects	1 2 3 4	1 2 3 4
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	1 2 3 4	1 2 3 4
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	1 2 3 4	1 2 3 4
14. Ability to manage the design process and evaluate outcomes	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance in your work area	Level to which skill was developed by your degree programme
Economic, social and environmental context		
15. Ability to demonstrate knowledge and understanding of the commercial and economic context of the work area	1 2 3 4	1 2 3 4
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context in the work area	1 2 3 4	1 2 3 4
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	1 2 3 4	1 2 3 4
18. Ability to demonstrate awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	1 2 3 4	1 2 3 4
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	1 2 3 4	1 2 3 4
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products relevant to the work area	1 2 3 4	1 2 3 4
21. Ability to demonstrate practical engineering skills relevant to the work area.	1 2 3 4	1 2 3 4
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc)	1 2 3 4	1 2 3 4
23. Ability to demonstrate understanding of the use of technical literature and other information sources in your work area	1 2 3 4	1 2 3 4
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance in your work area	Level to which skill was developed by your degree programme
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	1 2 3 4	1 2 3 4
26. Ability to demonstrate awareness of quality issues	1 2 3 4	1 2 3 4
27. Ability to work with technical uncertainty	1 2 3 4	1 2 3 4
28. Ability to work in a group on a major project	1 2 3 4	1 2 3 4
29.	1 2 3 4	1 2 3 4
30.	1 2 3 4	1 2 3 4
31.	1 2 3 4	1 2 3 4
32.	1 2 3 4	1 2 3 4
33.	1 2 3 4	1 2 3 4
34.	1 2 3 4	1 2 3 4

Please rank below the five most important competences according to your opinion. Please write the number of the item within the box. Mark on the first box the most important, on the second box the second most important and so on.

1	Item number	
2	Item number	
3	Item number	
4	Item number	
5	Item number	

Many thanks for your co-operation

EIE-Surveyor Employers Questionnaire

We are asking you to participate in a study into the skills and competencies graduates of Higher Education programmes require for success in careers in your organisation. The methodology being used follows that of the Tuning Project, an EU funded project which established an approach to comparing the perception of the importance of generic and specific skills, and how well they are developed. The study asks similar questions of students, academics, graduates and employers to establish a statistical dataset which is then used to make comparisons. In this questionnaire the questions asked deal with your perception of the importance of skills and competences to you and your perception of the level to which these have been developed in graduates of Higher Education Institutions you have recently employed. The information it provides is very valuable in helping to improve course planning for future students. The research is supported by the EIE-Surveyor Project, an EU funded project that includes partner institutions for across the whole of Europe.

Participation in this study is voluntary and you have the right not to answer any question or item, or to withdraw your consent and terminate participation at any time.

No personal identifier information is requested so your response to this questionnaire cannot be connected with you personally in any way. We will ensure the confidentiality of all information provided in your response.

****

By continuing, I agree to participate voluntarily in this survey. I understand the research purpose of the survey and the protection that will be given to any information I provide. I understand that any information provided by me will remain confidential with regard to my identity. I also understand that by participating in this study I am not waiving any of my legal rights.

I have been informed that I may contact Tony Ward, Department of Electronics, University of York, Heslington, York, YO10 5DD, email aew6@york.ac.uk if I have questions or comments about this survey.

Please read the instructions for each of the following questions. Review the response options carefully before you mark your answers. There are no right or wrong answers. Answer the questions as quickly and honestly as possible. Please answer all the questions in the questionnaire.

Please complete this questionnaire for a specific work area (such as process engineer; printed circuit board designer; etc.) and for one specific level of graduate (please see the questionnaire for an explanation of level). If you would like to provide a response for more than one specific work area or level please complete a separate questionnaire for each.

Questionnaire code = E

Background Information

1. Name of the organization: . . . . . .

2. Your position within the organization: (Please tick the first position in the list that best describes you. Please tick only **ONE** position)

Tick	Your Position
	35. Head of the organization
	36. Member of the Management Team
	37. Head of Department
	38. Head of Group or Section
	39. Manager
	40. Supervisor
	41. Worker
	42. Other, please specify : ……

2a. Are you directly involved in the recruitment of graduates? 1.Yes ☐ 2.No ☐

2b. Are you directly involved in the supervision of graduates? 1.Yes ☐ 2.No ☐

2c. Number of employees in your organization: . . . . . .

3. In what Country are you working?

Tick	Country	Tick	Country
	1. Austria		47. Liechtenstein
	2. Belgium		48. Lithuania
	3. Bulgaria		49. Luxembourg
	4. Cyprus		50. Malta
	5. Czech Republic		51. Netherlands
	6. Denmark		52. Norway
	7. Estonia		53. Poland
	8. Finland		54. Portugal
	9. France		55. Romania
	10. Germany		56. Slovak Republic
	11. Greece		57. Slovenia
	12. Hungary		58. Spain
	13. Iceland		59. Sweden
	14. Ireland		60. Turkey
	15. Italy		61. United Kingdom
	16. Latvia		

Other (please specify) ……

4. What is your Sex/Gender?:

Male 1. ☐

Female 2. ☐

5. What is your age?

20 or under	1. ☐
21 – 30	2. ☐
31 – 40	3. ☐
41 – 50	4. ☐
51 – 60	5. ☐
over 61	6. ☐

6. What is the specific work area for which you are completing this questionnaire?

. . . . . .

7. What 'level' of employee are you completing this questionnaire for?

Bachelor	1. ☐
Masters	2. ☐
Doctoral/PhD	3. ☐
Other	4. ☐

(please specify) ……..

8. Approximately how many graduates of Higher Education Institutions have you recruited into this work area in the past three years?

…….

9. Do you consider that Higher Education Institutions have given your employees adequate preparation for working in this work area in your company?

(Please circle one number)

Very much	Much	Some	Little	Very little
1	2	3	4	5

Generic Skills Question

For each of the skills listed below, please estimate:

—the **importance** of the skill or competence, in your opinion, for work in the work area you have chosen in your organisation;
—the **level** to which each skill or competence has been developed as demonstrated by the graduates you have recruited over the past three years to this work area.

The blank spaces may be used to indicate any other skills that you consider important but which do not appear in the list.

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

Skill/Competence	Importance to the work area	Level to which skill is demonstrated by recent graduates
1.Capacity for analysis and synthesis	1 2 3 4	1 2 3 4
2.Capacity for applying knowledge in practice	1 2 3 4	1 2 3 4
3.Planning and time management	1 2 3 4	1 2 3 4
4. Basic general technical knowledge of the profession of your work area	1 2 3 4	1 2 3 4
5.Grounding in basic knowledge of the profession of your work area	1 2 3 4	1 2 3 4
6.Oral and written communication in your native language	1 2 3 4	1 2 3 4
7.Knowledge of a second language	1 2 3 4	1 2 3 4
8.Elementary computing skills	1 2 3 4	1 2 3 4
9.Research skills	1 2 3 4	1 2 3 4
10.Capacity to learn	1 2 3 4	1 2 3 4
11.Information management skills (ability to retrieve and analyse information from different sources)	1 2 3 4	1 2 3 4
12.Critical and self-critical abilities	1 2 3 4	1 2 3 4
13.Capacity to adapt to new situations	1 2 3 4	1 2 3 4
14.Capacity for generating new ideas (creativity)	1 2 3 4	1 2 3 4
15.Problem solving	1 2 3 4	1 2 3 4
16.Decision-making	1 2 3 4	1 2 3 4
17.Teamworking	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance to the work area	Level to which skill is demonstrated by recent graduates
18.Interpersonal skills	1 2 3 4	1 2 3 4
19.Leadership	1 2 3 4	1 2 3 4
20.Ability to work in an interdisciplinary team	1 2 3 4	1 2 3 4
21.Ability to communicate with non-experts (in the field)	1 2 3 4	1 2 3 4
22.Appreciation of diversity and multiculturality	1 2 3 4	1 2 3 4
23.Ability to work in an international context	1 2 3 4	1 2 3 4
24.Understanding of cultures and customs of other countries	1 2 3 4	1 2 3 4
25.Ability to work autonomously	1 2 3 4	1 2 3 4
26.Project design and management	1 2 3 4	1 2 3 4
27.Initiative and entrepreneurial spirit	1 2 3 4	1 2 3 4
28.Appreciation of ethical issues	1 2 3 4	1 2 3 4
29.Concern for quality	1 2 3 4	1 2 3 4
30.Will to succeed	1 2 3 4	1 2 3 4
31. Patents and Intellectual Property Rights	1 2 3 4	1 2 3 4
32. International Relations and Collaborations	1 2 3 4	1 2 3 4
33.	1 2 3 4	1 2 3 4
34.	1 2 3 4	1 2 3 4

Please rank below the five most important competences according to your opinion. Please write the number of the item within the box. Mark on the first box the most important, on the second box the second most important and so on.

1	Item number	
2	Item number	
3	Item number	
4	Item number	
5	Item number	

Ability in Languages other than Native Language

For each of the languages listed below, please estimate:

—the **importance** of being able to communicate effectively verbally and in written form, in your opinion, for work in the work area you have chosen in your organisation;
—the **level** to which ability has been developed as demonstrated by the graduates you have recruited over the past three years to this work area.

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

	Importance								Level of development as a demonstrated by graduates							
Language	Written				Spoken				Written				Spoken			
Bulgarian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Czech	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Danish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Dutch	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
English	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Estonian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Finnish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
French	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
German	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Greek	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Hungarian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Icelandic	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Irish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Italian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Latvian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Lithuanian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Maltese	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Norwegian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Polish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Portuguese	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Romanian	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Slovak	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Slovene	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Spanish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Swedish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Turkish	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

Specific Skills Question

For each of the skills listed below, please estimate:

—the **importance** of the skill or competence, in your opinion, for work in the work area you have chosen in your organisation;
—the **level** to which each skill or competence has been developed as demonstrated by the graduates you have recruited over the past three years to this work area.

The blank spaces may be used to indicate any other skills that you consider important but which do not appear in the list.

Please use the following scale:
1 = none; 2 = weak; 3 = considerable; 4 = strong.

Skill/Competence	Importance to the work area	Level to which skill is demonstrated by recent graduates
Fundamentals		
1. Ability to demonstrate knowledge and understanding of scientific facts, concepts, theories, principles and methods necessary to underpin the engineering discipline of the work area	1 2 3 4	1 2 3 4
2. Ability to demonstrate knowledge and understanding of mathematics principles and methods necessary to underpin the engineering discipline of the work area	1 2 3 4	1 2 3 4
3. Ability to apply and integrate knowledge and understanding of other engineering disciplines appropriate to the work area	1 2 3 4	1 2 3 4
4. Ability to demonstrate an appreciation of the wider multidisciplinary engineering context and its underlying principles	1 2 3 4	1 2 3 4
5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations affecting the exercise of engineering judgement in the work area	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance to the work area	Level to which skill is demonstrated by recent graduates
Engineering Analysis		
6. Ability to apply appropriate quantitative mathematical, science and engineering methods and computer software to solve problems in the work area	1 2 3 4	1 2 3 4
7. Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques in the work area	1 2 3 4	1 2 3 4
8. Ability to apply a systems approach to engineering problems in the work area	1 2 3 4	1 2 3 4
Design		
9. Ability to investigate and define a problem and identify constraints including environmental and sustainability limitations, health and safety and risk assessment issues	1 2 3 4	1 2 3 4
10. Ability to understand customer and user needs and the importance of considerations such as aesthetics in the design process	1 2 3 4	1 2 3 4
11. Ability to identify and manage cost drivers in designs and projects	1 2 3 4	1 2 3 4
12. Ability to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs	1 2 3 4	1 2 3 4
13. Ability to undertake design activities and projects to ensure fitness for purpose for all aspects of the problem including production, operation, maintenance and disposal	1 2 3 4	1 2 3 4
14. Ability to manage the design process and evaluate outcomes	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance to the work area	Level to which skill is demonstrated by recent graduates
Economic, social and environmental context		
15. Ability to demonstrate knowledge and understanding of the commercial and economic context of the work area	1 2 3 4	1 2 3 4
16. Ability to demonstrate knowledge of management techniques which may be used to achieve engineering objectives within the commercial and economic context in the work area	1 2 3 4	1 2 3 4
17. Ability to demonstrate understanding of the requirement for engineering activities to promote sustainable development	1 2 3 4	1 2 3 4
18. Ability to demonstrate awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues	1 2 3 4	1 2 3 4
19. Ability to demonstrate understanding of the need for a high level of professional and ethical conduct in engineering	1 2 3 4	1 2 3 4
20. Ability to demonstrate knowledge of characteristics of particular materials, equipment, processes, or products relevant to the work area	1 2 3 4	1 2 3 4
21. Ability to demonstrate practical engineering skills relevant to the work area.	1 2 3 4	1 2 3 4
22. Ability to demonstrate understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc)	1 2 3 4	1 2 3 4
23. Ability to demonstrate understanding of the use of technical literature and other information sources in your work area	1 2 3 4	1 2 3 4
24. Ability to demonstrate awareness of the nature of intellectual property and contractual issues	1 2 3 4	1 2 3 4

1 = none; 2 = weak; 3 = considerable; 4 = strong

Skill/Competence	Importance to the work area	Level to which skill is demonstrated by recent graduates
25. Ability to demonstrate understanding of appropriate codes of practice and industry standards	1 2 3 4	1 2 3 4
26. Ability to demonstrate awareness of quality issues	1 2 3 4	1 2 3 4
27. Ability to work with technical uncertainty	1 2 3 4	1 2 3 4
28. Ability to work in a group on a major project	1 2 3 4	1 2 3 4
29.	1 2 3 4	1 2 3 4
30.	1 2 3 4	1 2 3 4
31.	1 2 3 4	1 2 3 4
32.	1 2 3 4	1 2 3 4
33.	1 2 3 4	1 2 3 4
34.	1 2 3 4	1 2 3 4

Please rank below the five most important competences according to your opinion. Please write the number of the item within the box. Mark on the first box the most important, on the second box the second most important and so on.

1	Item number	
2	Item number	
3	Item number	
4	Item number	
5	Item number	

Many thanks for your co-operation

EIE · SURVEYOR

Task 1.1 of the EIE-Surveyor project has been dedicated to the application of the Tuning Methodology to the Electrical and Information Engineering discipline area. This report presents the approach taken to this application and an analysis of the results obtained from a pan-European survey of students, academics, graduates and employers. In total 3,275 completed questionnaires have been received and entered into a single SPSS dataset. The responses have enabled analyses in a number of different ways to be carried out including comparisons by gender, academic study level, country and by competence both individually and in groups they form through the application of standard statistical data reduction techniques. Attention has been paid to the clarification of the scope of the EIE area as the boundaries between technical degrees and broader arts degrees are blurred in places. The project has confirmed the appropriateness of the Tuning Methodology to the discipline area and, in line with other Tuning studies, has shown that the results do differ between countries and that clustering of countries does occur in some analyses. The analysis shows that, in terms of general preparedness for employment academic typically over-rate while students generally under-rate their view on how well they are preparing students relative to employers. This perhaps reflects a general optimism of employment potential by academics and pessimism by students. In general employers and academics rate competences higher in importance than students and graduates, even allowing for the unevenness in the average responses of these different stakeholders. The most important generic competence is problem solving followed by elementary computing skills and knowledge of a second language. A number of differences between rated importance and level of development of the competences emerge providing evidence that adjustment of curricula would be beneficial. Finally the analysis shows that the English language is the only second language that is rated as anything more than weakly important. This view is shared by all stakeholder groups. The value of the Tuning Methodology and of the analyses carried out has been demonstrated by this project task and the specific findings point clearly to areas where more work can be undertaken. There are gaps in the data for some countries and for some stakeholder groups within some countries. It is recommended that attempts are made to fill these gaps so that the analysis can be extended to be more representative of the whole of Europe. The issue of clustering needs to be examined in more detail and a focussed study in this area may reveal some interesting European country clusters or some regional differences.

For any information and documentation
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