Ready for the Energy and Water Industries: Knowledge and Skills of Business Professionals and Executives

– Synopsis of the Results –

UNIVERSITÄT LEIPZIG

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Contents

Tables....2
Figures....3
1 Study rationale and objectives....4
2 Study design and methodology....6
3 Results....8
3.1 Results of the written survey....8
3.2 Results of the spoken survey....38
3.2.1 Method....38
3.2.2 Risk management findings....41
3.2.3 Results for Ecology & Sustainability....46
3.2.4 Findings for meta-competencies (soft skills)....52
4 Summary and Outlook....58

Tables

Table 1: Areas ranked by estimated importance 9
Table 2: Structural answer patterns for risk management 44
Table 3: Structural answer patterns for ecology and sustainability 49
Table 4: Structural answer patterns for meta-competencies 55

Figures

Figure 1: Overview 5
Figure 2: Germany-wide expert survey 7
Figure 3: Economics – gaining knowledge, skills and competencies 10
Figure 4: (Energy) law – gaining knowledge, skills and competencies 11
Figure 5: Risk management – gaining knowledge, skills and competencies 13
Figure 6: Technology – gaining knowledge, skills and competencies 14
Figure 7: International accounting – gaining knowledge, skills and competencies 15
Figure 8: Ecology and sustainability – gaining knowledge, skills and competencies 16
Figure 9: Functional work areas of the surveyed university graduates 18
Figure 10: Importance of individual items in general knowledge and skills 20
Figure 11: Economics: Importance of individual items 23
Figure 12: (Energy) law: Importance of individual items 26
Figure 13: Risk management: Importance of individual items 29
Figure 14: International accounting: Importance of individual items 32
Figure 15: Ecology & sustainability: Importance of individual items 35
Figure 16: Relevance of risk management to the energy and water industries 42
Figure 17: Risk management-related requirements for university graduates 43
Figure 18: Relevance of ecology and sustainability for the energy and water industries – with requirements for university business graduates 47
Figure 19: Relevance of renewable energy for the energy and water industries – with requirements for university business graduates 48
Figure 20: Distribution of statement content 52
Figure 21: Meta-competencies in the energy and water industries 54

1 Study rationale and objectives

Dynamic changes taking place in the energy and water industries are bringing with them new and different demands on business specialists and managers of enterprises. Coupled with this is a higher education landscape changed by the so-called Bologna process that does away with diploma programs and introduces the system of bachelor and masters degrees. These developments, together with an emerging, demographically induced shortages of specialists call for an industry-focused realignment of academic business education and training. This will require curricula geared to both recent scientific findings in various disciplines and the current and future needs of the energy and water industries for specialists and managers. So far, the latter have hardly been studied systematically. The present study fills this gap.

In order to create a broad base of data for the industry and prospective education and training offerings, the Institute for Business Education and Management Training, the Scientific Advisory Council for Education in Energy Management of Universität Leipzig and the German Association of Energy and Water Industries (BDEW)[1] conducted a study during the period September 2010 to June 2011 that surveyed a) the changed professional demands on business specialists and managers and b) the current and future knowledge and skills of university business graduates in member organizations of the BDEW. This study has the following three components.

1. A standard written survey of business executives or heads of specialized business departments as well as those responsible for education and training (short title: **Company survey**);

2. A standardized written survey of university business graduates in the BDEW's member companies (short: **Graduate survey**) and,

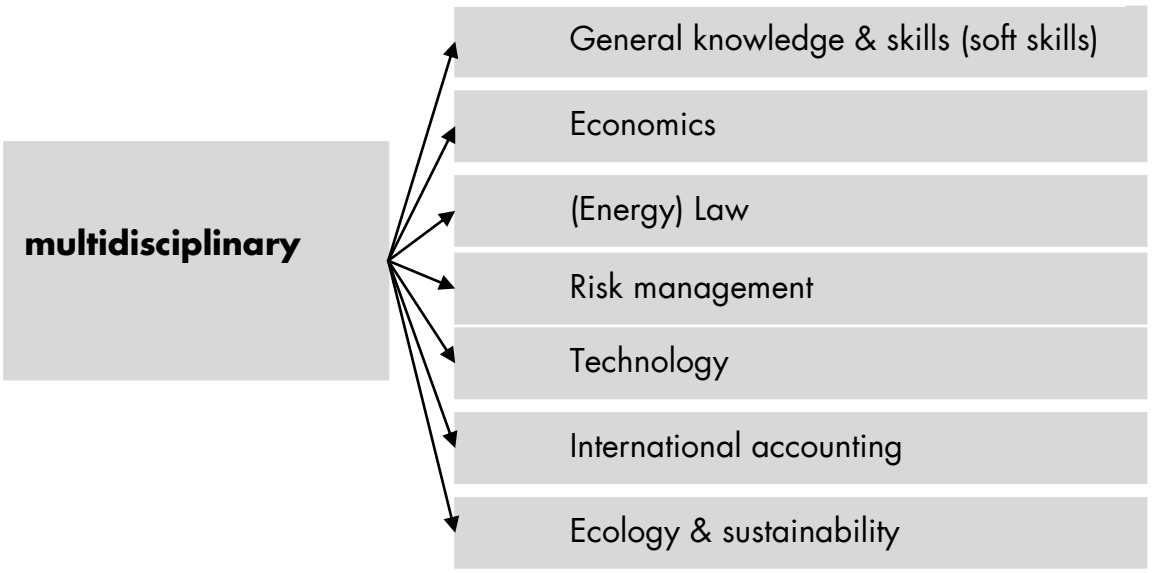
[1] The BDEW advises and supports approximately 1,800 member enterprises and is the central clearing house for all questions relating to natural gas, electricity, district heating, as well as water and waste water (www.bdew.de).

3. In-person interviews with board members, business executives or department heads (short: **Expert survey**).

We present the key findings from these studies in this publication.

Chapter 2 details the study's structure and methodological approach. Chapter 3 presents our results, divided into findings from the written (3.1) and the oral survey (3.2). Section 3.1 begins with a comparative analysis of how the companies on the one hand and the graduates on the other gauge the importance of multidisciplinary knowledge, skills and competencies in areas that had proved to be particularly requirement-defining in preliminary studies. Involved are knowledge, skills and competencies related to soft skills, economics, (energy) law, risk management, technology, international accounting as well as ecology & sustainability (see Fig. 1).

Figure 1: Overview



Also shown is the manner in which the graduates gained the knowledge, skills and competencies that were identified as important, be it at university, "on the job" or through continuing education.

Next, the individual areas and items[2] are examined separately; specifically, in relation to the graduates' various functional areas. This was done for the purpose of analyzing the relationships between the graduates' current work environment and their response behavior. The written survey findings are augmented with representative quotes and statements from the 26 interviews with industry experts. Section 3.2 deals at length with results of the expert interviews. Because of the many divergent opinions, we primarily present typical answer patterns that have both explanatory value and suggest actions required for curriculum development. Chapter 4 summarizes the study's major findings and closes with a perspective on next steps.

2 Study design and methodology

The questionnaires used for the standard written surveys were developed in the Institute for Business Education and Management Training of Leipzig University.

The company survey questionnaire covers seven subject complexes with 27 questions and 168 items. For surveying the graduates, the company survey was merely expanded with "personal information" and "company information". A four point rating scale was used in both surveys, for which the items were formulated for specific target groups. While the companies were expected to estimate the requirements called-for from their perspective *(e.g. "The university graduates are able to describe the types of risk")*[3], the university graduates had to assess the knowledge, skills and competencies demanded of them in their daily work (e.g. *"I must be able to describe the types of risks")*. In addition, the graduates were asked if they had obtained the necessary professional knowledge, skills and competencies during their studies, "on the job" or through continuing education.

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[2] By items are meant the statements making up the questionnaires that had to be evaluated by those surveyed. The study contains about 350 items.

[3] The following rating scale was used in the written company survey: 1 = not important, 2 = less important; 3 = important, 4 = very important.

A total 311 companies of all types and sizes (by revenues) participated in the company survey, while 76 university graduates took part in the graduate survey. Approximately three quarters of these graduates are employed in large companies with annual revenues over 500 million €; 74 % have diplomas and 26 % a bachelors or masters degrees, specifically in business or macroeconomics, industrial engineering, business information systems or business law. Of the graduates, 83 % received their degrees within the previous five years, with 62 % having graduated during the last two years.

Interviews with 26 interlocutors from 20 companies spread throughout Germany were conducted for the expert survey (see Fig. 2).

Figure 2: Germany-wide expert survey

The interviews, running 1,010 minutes in total, were transcribed on approximately 350 pages that contain about 2,500 coded statements. The transcripts were evaluated with the help of software.

The results of the written surveys are detailed in the next chapter.

3 Results

3.1 Results of the written survey

We begin by presenting the importance of multidisciplinary knowledge, skills and competencies in seven areas (soft skills, (energy) law, economics, risk management, international accounting, technology and ecology & sustainability) in three study groups. The first study group comprises all surveyed university graduates; the second group, the surveyed energy companies; and the third group, the surveyed water industry companies. The energy industry survey group consists of the electricity, natural gas and district heating sectors. The results for these sectors are combined under the energy industry because of their broad homogeneity.

Summarized findings

Table 1 shows the importance ranking of multidisciplinary knowledge, skills and competencies in the individual areas from the perspective of the graduates (Column 2) as well as the perspective of the companies (Column 3: energy companies; column 4: water industry companies). Rank 1 means that this area displays the highest mean value (MV) of all items and was judged to be as most important by the respective survey group. Ranking 7 on the other hand means that this subject area has the lowest mean value, and that the respective study group rated this area as least important in comparison with the other subject areas.

Table 1: Areas ranked by estimated importance

Rank	Written survey of graduates	Written company surveys	
		Energy industry	Water industry
1	General knowledge & skills (Soft Skills) MV = 2.96	General knowledge & skills (Soft Skills) MV = 3.28	General knowledge & skills (Soft Skills) MV = 3.26
2	Economics MV = 2.40	Economics MV = 3.10	Economics MV = 3.03
3	(Energy)Law MV = 2.20	Int'l. accounting MV = 3.00	Risk management MV = 2.89
4	Risk management MV = 1.93	(Energy)Law MV = 2.98	Int'l. accounting MV = 2.82
5	Technology MV = 1.92	Risk management MV = 2.95	(Energy)Law MV = 2.73
6	Int'l. accounting MV = 1.80	Ecology/ Sustainability MV = 2.57	Technology MV = 2.66
7	Ecology/ Sustainability MV = 1.73	Technology MV = 2.54	Ecology/ Sustainability MV = 2.53

The findings shown in the table are explained below by subject and ranking, beginning in each case with the graduate survey.

General knowledge & skills (soft skills)

The university graduates rated general knowledge & skills (soft skills) as important to very important (MV 2.96) so that they occupy rank 1 compared with knowledge and skills in other subject areas. Compared with the companies, which also ranked general knowledge and skills highest (energy industry: MV = 3.28; water industry:

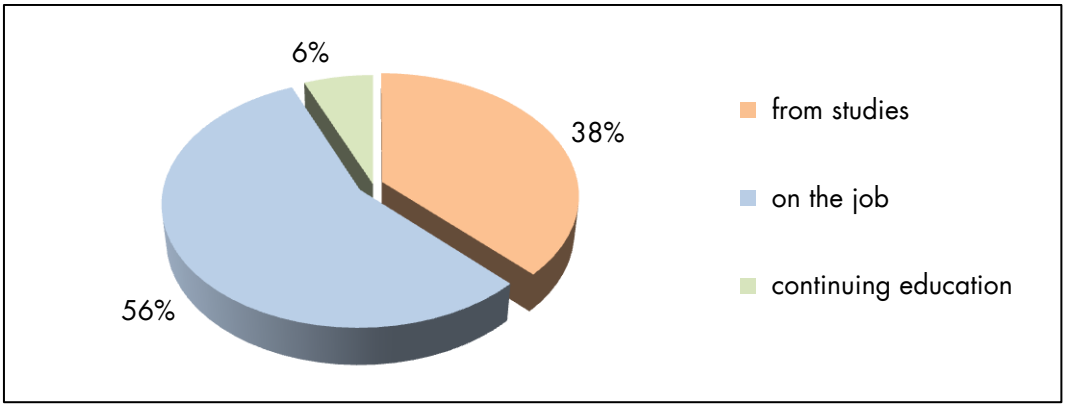
MV = 3.26), the ranking by the university graduates came out slightly lower. Taken together, the findings clearly demonstrate the prominent position of general knowledge and skills in comparison with the other areas.

Economics

The graduates rate multidisciplinary knowledge, skills and competencies in the field of economics as important. The mean is 2.40, which is lower than the company survey mean (energy industry: MV = 3.10; water industry: MV = 3.03). Nonetheless, multidisciplinary knowledge, skills and competencies in the field of economics occupy the second rank both in the graduate survey as well as in the company survey.

Figure 3 pictures the extent to which the graduates obtained knowledge, skills and competencies in economics from their studies, "on the job" and through continuing education.

Figure 3: Economics – gaining knowledge, skills and competencies



The figure shows that more than half (56%) of the graduates obtained the economics knowledge, skills and competencies needed for their work "on the job", not at university or through continuing education. By contrast, the share of knowledge, skills and competencies gained through university studies amounted to just 38%. This share is high compared with the other areas (soft skills, (energy) law, risk management, technology, international accounting, ecology & sustainability); only in the area of international accounting was a higher share (62%) of relevant knowledge, skills and competencies obtained from university studies. Just 6% of economics knowledge, skills and

competencies were obtained through continuing education, making up the smallest share among all the areas.

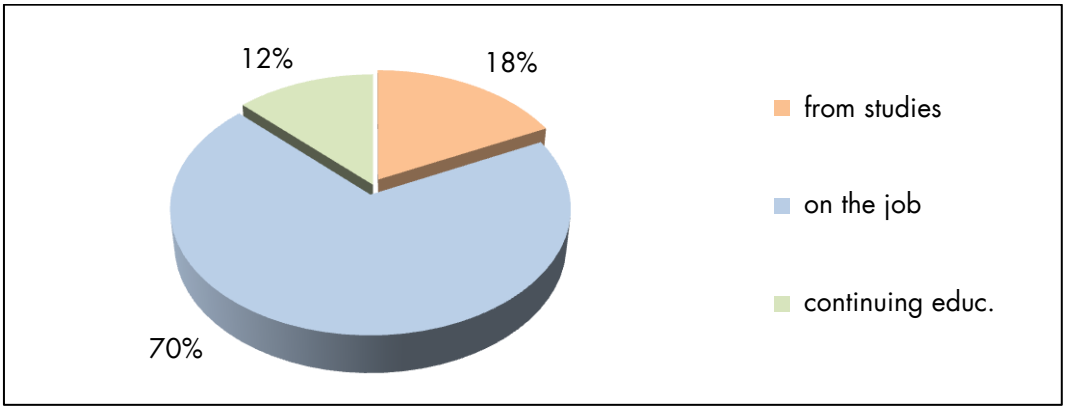
Summing up, we can say that all three survey groups rated knowledge, skills and competencies in the economics subject area as important. Graduates gain economics knowledge and expertise primarily "on the job," but also to a relatively greater extent in contrast to the other subject areas from their university studies and least from continuing education.

(Energy) law

The graduates rate knowledge, skills and competencies in (energy) law as less important to important. The mean value equals 2.20 and so is lower than the mean values from the company surveys (energy industry: 2.98; water industry: 2.73). The survey results also differ with respect to the rankings. In the graduate survey ranking, knowledge, skills and competencies in energy law end up in third place. Although higher rankings were determined for the subject area (energy) law from the company surveys (see above), (energy) law-related knowledge, skills and competencies only occupy fourth place (energy industry) or fifth place (water industry) in the company surveys.

Figure 4 pictures the extent to which the graduates obtained knowledge, skills and competencies in (energy) law required in their work from their university studies, "on the job" and through continuing education.

Figure 4: (Energy) law – gaining knowledge, skills and competencies



A 70 % share of knowledge, skills and competencies in (energy) law acquired "on the job" ranks (energy) law above the economics area (56%). This represents the second

largest share among all seven subject areas (soft skills, economics, (energy) law, risk management, technology, international accounting, ecology & sustainability). Eighteen percent of knowledge, skills and competencies in (energy) law are obtained through university studies and 12% through continuing education. The share of knowledge, skills and competencies obtained through continuing education is the second highest for all seven subject areas. Only in the ecology & sustainability areas are more knowledge, skills and competencies obtained through continuing education.

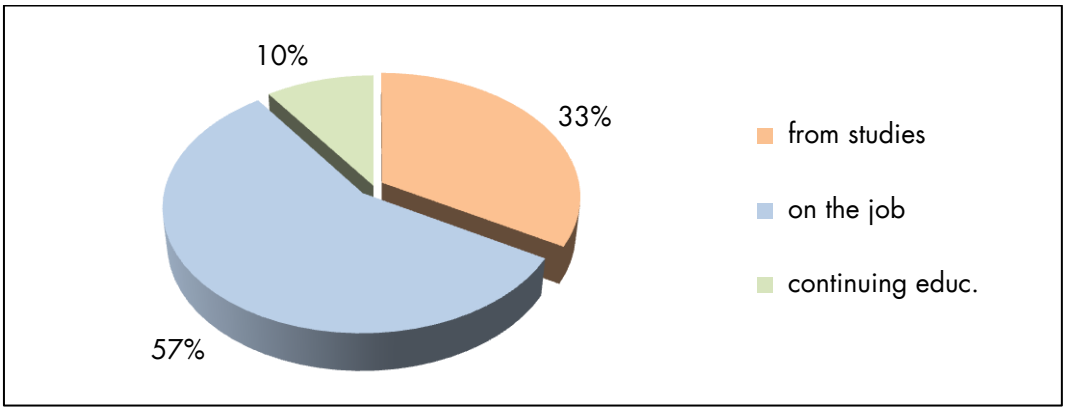
In summary, it is clear that the companies in these industries rate knowledge, skills and competencies in the subject area of (energy) law as more important than do the graduates. Moreover, the graduates admit that they did not obtain the preponderant part of the required knowledge and expertise during their university studies, but "on the job".

Risk management

The graduates rate knowledge, skills and competencies in the area of risk management as less important. The mean is 1.93, which puts it on the borderline between "not important" and "less important." The mean values are distinctly higher in the company survey. For energy companies, the mean is 2.95; for the water and waste water companies it is 2.89. The difference between the mean values of the graduate survey on the one hand and the company survey on the other hand amounts to approximately one unit on the ratings scale. In the graduate survey, risk management occupies fourth place in the subject area rankings, fifth place in the survey of companies in the energy industry and third place in the survey of water industry companies.

Figure 5 shows to what extent the graduates gained knowledge, skills and competencies in risk management in their university studies, "on the job" and through continuing education.

Figure 5: Risk management – gaining knowledge, skills and competencies



The university graduates obtained roughly a third of the knowledge, skills and competencies required for risk management from their university studies, while two thirds were obtained either "on the job" or through continuing education.

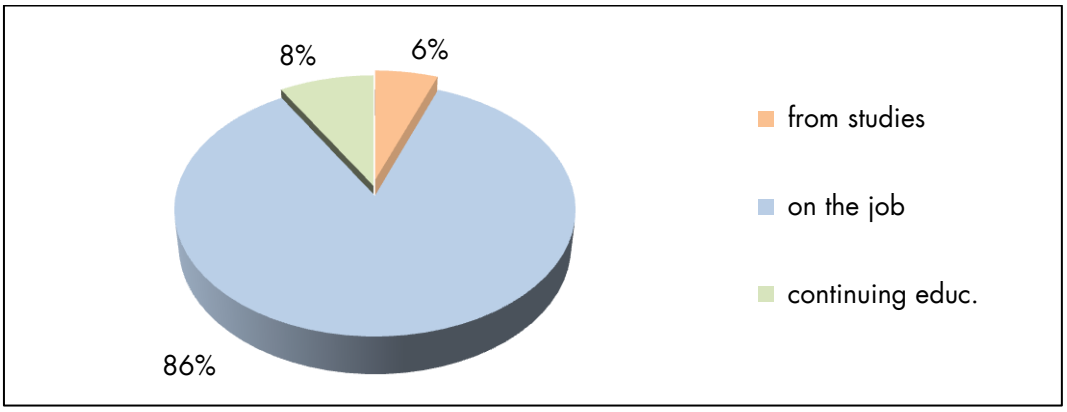
It can be asserted for risk management that the industrial companies assigned substantially higher importance to knowledge, skills and competencies to this subject area than did the graduates. Based on their answers, the graduates obtained more than half the required knowledge and expertise "on the job," but also one third during their studies.

Technology

The graduates regard technological knowledge, skills and competencies as less important. The mean is 1.92, which puts it on the borderline between "not important" and "less important." That puts it lower than the company survey mean values (energy industry: MV = 2.54; water industry: MV = 2.66). However, a different picture emerges when we look at the subject area rankings: ranked fifth, technology ranks highest in the graduate survey. By contrast, it occupies seventh place (last) on the energy company survey and sixth place in the water industry survey.

Figure 6 shows the extent to which the graduates gained technological knowledge, skills and competencies in their university studies, "on the job" and through continuing education.

Figure 6: Technology – gaining knowledge, skills and competencies



The figure clearly shows that technological knowledge, skills and competencies were obtained almost exclusively after university, namely "on the job" (86%) for the most part and to a lesser degree through continuing education (8%). Compared to the other subject areas (soft skills, economics, (energy) law, risk management, international accounting, ecology & sustainability), the share of knowledge, skills and competencies acquired "on the job" ranked highest. The graduates estimate that just 6 % of technological knowledge, skills and competencies were acquired during their studies. In none of the other areas is the share of knowledge, skills and competencies gained through university studies lower.

In summary, it appears that the industrial companies assign a much higher value to knowledge, skills and competencies in the technology area than do the graduates. The graduate students estimate that they acquired the least amount of required knowledge and skills in the technology area during their studies and the largest part of such knowledge and skills "on the job," compared with other areas.

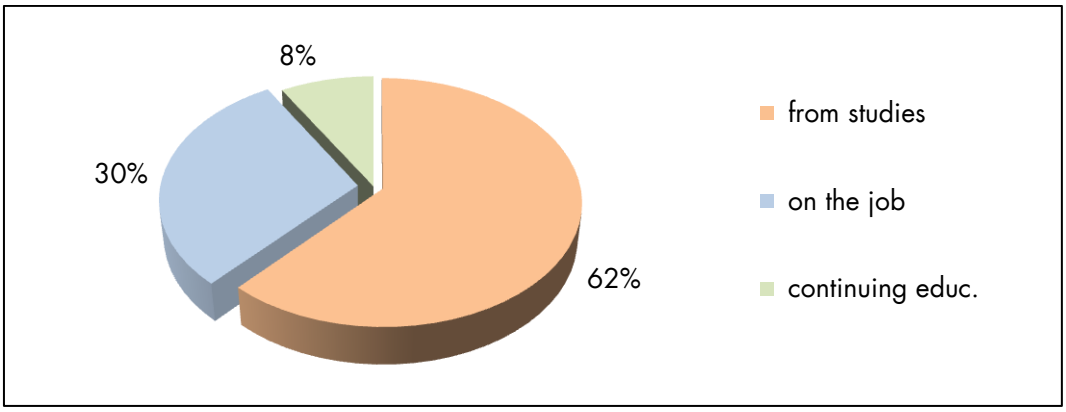
International accounting

The university graduates rate knowledge, skills and competencies in the international accounting area as less important (MV = 1.80). This differs distinctly from the company polls. Both the energy companies as well as the water companies assess knowledge, skills and competencies in the international accounting area as important: (Energy industry: MV = 3.00; water industry: MV = 2.82). A look at the rankings corroborates

this difference: international accounting, ranked third (energy industry) and fourth (water industry) in the company surveys, attains only sixth place in the graduate survey.

Figure 7 shows the extent to which the graduates gained knowledge, skills and competencies in international accounting from their university studies, "on the job" and through continuing education.

Figure 7: International accounting – gaining knowledge, skills and competencies



The share of knowledge, skills and competencies acquired "on the job" amounts to only 30 % for international accounting; in no other area (soft skills, economics, (energy) law, risk management, technology, ecology & sustainability) is the share this low. University graduates obtained the requisite knowledge, skills and competencies primarily in the course of their studies (62 %). Compared with the other areas, this is the highest share for knowledge and expertise obtained from university studies.

To sum up, this confirms that the industrial companies assess knowledge, skills and competencies in the area of international accounting as much more important as do the graduates, and, in contrast to the other areas, the graduates acquired the majority of the required expertise and knowledge in the course of their studies.

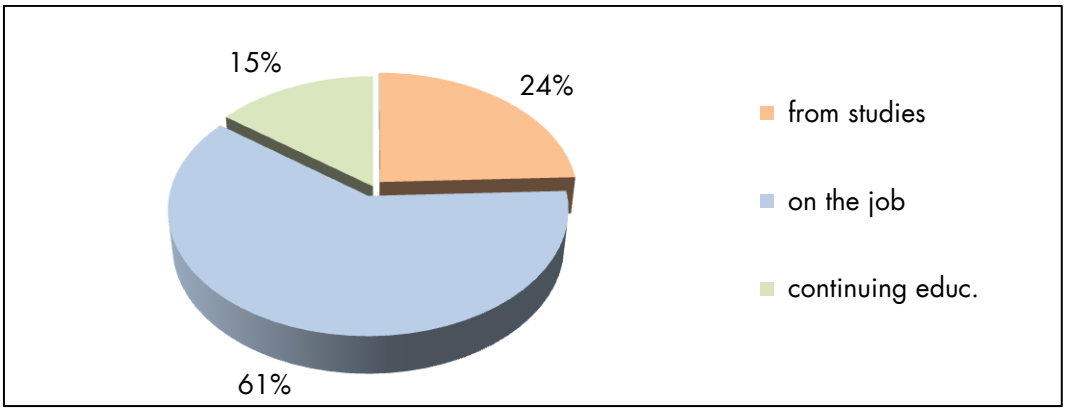
Ecology and sustainability

The university graduates rate knowledge, skills and competencies in the area of ecology & sustainability on average as less important (MV = 1.73). The graduates' estimate here clearly differs from that of the companies, which overall tend to regard it as important (energy industry: MV = 2.57; water industry: MV = 2.53). In the subject area rankings, ecology & sustainability ranks seventh in the graduate surveys, putting it in

last place. The same holds true for the water company survey, while the energy supply companies in their survey rank ecology & sustainability sixth.

Figure 8 shows the extent to which the university graduates gained knowledge, skills and competencies in the area of ecology & sustainability in the course of their studies, "on the job" and through continuing education.

Figure 8: Ecology and sustainability – gaining knowledge, skills and competencies



The university graduates obtained the preponderant part of their knowledge, skills and competencies "on the job" (61 %). At 15 %, the share obtained through continuing education is very high and is not reached in any other area. Approximately a fourth (24 %) of knowledge, skills and competencies stemmed from their university studies.

Notably, the industrial companies estimate the importance of ecology & sustainability as being far higher than do the graduates. Contrasted with the other areas, the graduates acquire a larger part of the knowledge and expertise required for this area through continuing education.

Overall, it becomes clear that the university business graduates on average estimate knowledge, skills and competencies in the areas soft skills, economy, (energy) law, risk management, international accounting and ecology & sustainability as distinctly less important than do the business executives or business department heads. The calculated mean values for the graduates study group range between 0.3 scale units (soft skills area) and 1.2 scale units (international accounting area) lower than for the energy and water industries study groups. These differences can be accounted for at least in part by the different perspectives from which these estimates were made. The univer-

sity graduates were called on to assess how important the knowledge and expertise in each area was for their day-to-day work. This meant that knowledge, skills and competencies not required for their daily work were rated as less important. In contrast, the business excutives or heads of business departments evaluated how important the knowledge and expertise in the various areas are in meeting the demands of the energy and water businesses independent of any specific tasks.

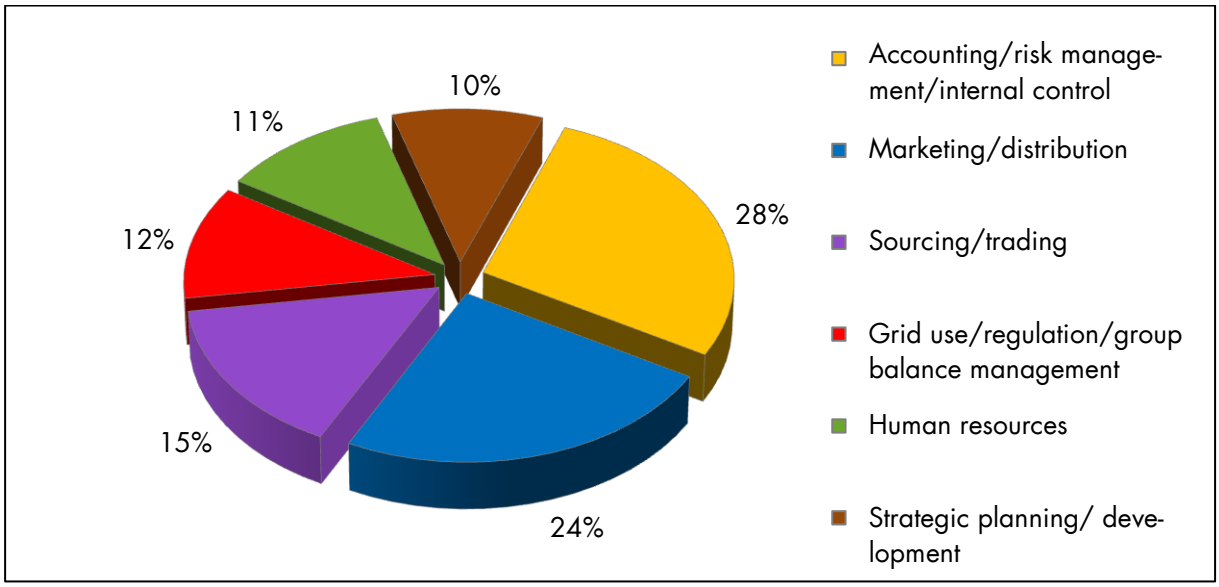
In addition, the university graduates evidently did not acquire a large part of the necessary knowledge and expertise in the course of their studies, but primarily "on the job" instead. This applies particularly to (energy) law (70 %) and technology (86 %). International accounting is the exception; here, the graduates indicate having gained the preponderant part of the relevant knowledge and expertise (62 %) from their studies.

The graduate survey findings confirm inter alia the results of an analysis of business studies offerings at German universities (see "Analysis of business study offerings at German universities for the energy and water industries," March 2011). Both studies identify a distinct gap between industry requirements and the existing academic education programs.

Below, we present the importance of individual items from the areas soft skills, economics, (energy) law, risk management, international accounting and ecology & sustainability in relation to the graduates' various functional work areas.

We differentiated eight study groups for purposes of the analysis. The first group comprises the surveyed energy companies and the second one the surveyed water industry companies. The surveyed university graduates make up study groups three through eight differentiated by the functional company areas that the graduates reported working in at the time of the survey.

Figure 9: Functional work areas of the surveyed university graduates



Twenty-eight percent of the university graduates worked in accounting/internal control/risk management, followed by marketing/distribution (24 %) and sourcing/trading (15 %). Twelve percent worked in grid use/regulation/group balance management, 11 % in human resources and 10 % in the strategic planning/development function.

Figures 10 through 15 below depict the importance estimates for individual items in the subject areas soft skills, economics, (energy) law, risk management, international accounting and ecology & sustainability, employing the mean values. Each item is described by four bars:

- The first bar (dark grey) represents the mean value of the energy company survey. The energy category includes (as in Chapter 3) companies in the natural gas, electricity and district heating sectors.
- The second bar (light grey) represents the mean value for the water industry companies. The energy category includes (as in Chapter 3) companies in the water/waste water sector.
- The third bar shows the mean for the group of graduates who rated the respective item as most important compared to the other graduates study groups. The third bar's color coding corresponds in each instance to the coloration of the university graduates' functional areas (see Fig. 9).

- The fourth bar represents the mean for the graduates group that ranked the respective item as least important[4], compared with the other graduates study groups. The color coding also corresponds to the coloration of the university graduates' respective functional areas (see Fig. 9).

After each of the presented subject areas, we present excerpts from the expert interviews – even when they differ occasionally from the written surveys – that best exemplify how the interviewees assess the knowledge and expertise required in each subject area.

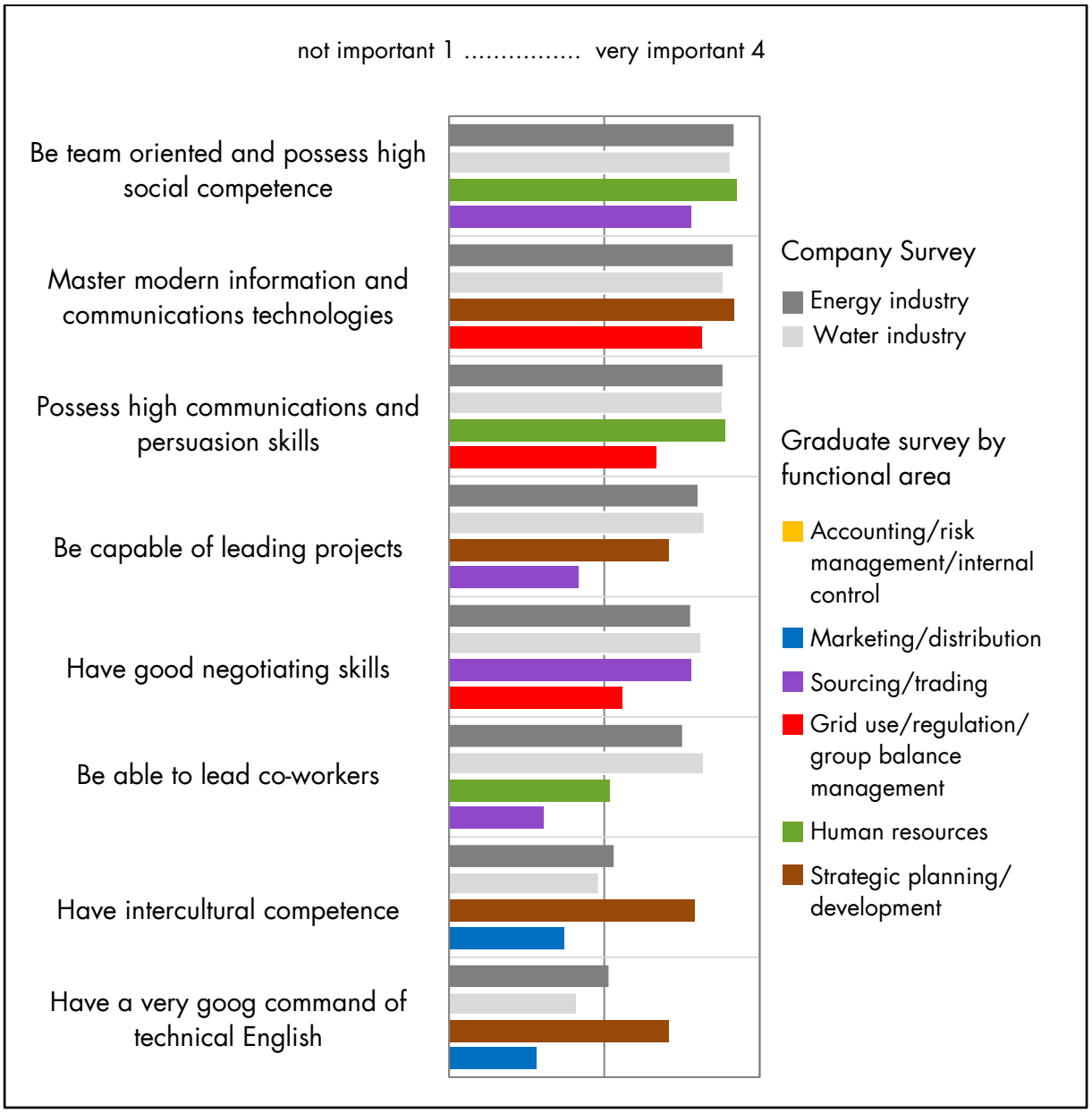
General knowledge & skills (soft skills)

The prominent position general knowledge & skills holds for all study groups (companies and graduates) was highlighted earlier. Figure 10 (next page) shows the importance of the individual items that constitute the soft skills subject area.

- The item *"be team oriented and possess high social competence"* is judged to be very important by both the energy companies (MV = 3.75) and the water industry companies (MV = 3.72). The graduates viewed it in similar fashion. The highest mean was recorded for graduates working in human resources (MV = 3.78). The lowest mean comes from the graduates in sourcing/trading (MV = 3.33) who judged the item as important.
- The ability to *"master modern information and communications technologies"* is judged to be very important by those surveyed in the energy industry (MV = 3.74) and in the water industry (MV = 3.65). The highest mean is scored by graduates employed in the strategic planning/development area (MV = 3.75); the lowest, for graduates working in grid use/regulation/group balance management (MV = 3.44). This item is also ranked as important to very important by the graduates as a whole.

[4] The mean values falling between these two groups of graduates are not shown for clarity's sake.

Figure 10: Importance of individual items in general knowledge and skills



- The energy companies (MV = 3.64) and water industry companies (MV = 3.64) both rated the item *"possess high communications and persuasion skills"* as important to very important. For graduates in the human resources area (MV = 3.67), these capabilities were also important to very important. The lowest mean value emerges from graduates in the grid use/regulation/group balance management area (MV = 3.00) who rate this item merely as important.
- The item "*be capable of leading projects*" is important to very important for energy companies (MV = 3.40) and water companies (MV = 3.47). Graduates in the strategic planning/development function (MV = 3.13) regard the item as

important. The lowest mean value comes from the sourcing/trading functional area graduates (MV = 2.25) who judge it to be less important.

- The *"have good negotiating skills"* item is rated as important to very important by the companies (MV = 3.33) and the water industry companies (MV = 3.44). University graduates from the sourcing/trading functional area (MV = 3.33) also rate this capability as being important to very important. By contrast, those surveyed from the grid use/regulation/group balance management (MV = 2.67) function rate it as important.
- The ability to *"lead co-workers"* is rated as important to very important by the energy companies (MV = 3.25) and the water industry companies (MV = 3.46). This function is clearly rated as less important by graduates in all functional areas. The graduates in human resources attain the highest mean (MV = 2.56) in judging this quality as being important. The graduates in sourcing/trading (MV = 1.92) give it the lowest score. They regard this activity as less important.
- The item *"possess intercultural competence"* is rated as important by the energy companies (MV = 2.59) and those surveyed in the water industry (MV = 2.45). Distinct differences characterize the graduate survey in this regard. Graduates working in strategic planning/development (MV = 3.38) rate this ability as important to very important. By contrast, graduates employed in the marketing/distribution area (MV = 2.11) rank intercultural competence as less important.
- The item *"have a very good command of technical English"* is ranked from less important to important by the energy companies (MV = 2.54) and the water industry companies (MV = 2.23). The rankings by the graduates vary considerably. Graduates in the strategic planning/development area (MV = 3.13) rate it as important, while the marketing/distribution graduates (MV = 1.84) rate the item as less important.

Overall, the importance ratings of items in the soft skills subject area vary considerably. A few items are judged important to very important by all study groups. For ex-

ample, this applies to *"be team oriented and possess high social competence"* and to *"master modern information and communications technologies"*. Other items (such as *"be able to lead co-workers"*), judged to be important to very important by both energy and water industry companies, are considered less important by the graduates. Furthermore, there a certain items ("*have intercultural competence*" and "*have a very good command of technical English*") that both the energy and the water industry companies consider to be less important to important. Graduates from different functional areas meanwhile rate these items in much more differentiated fashion (from less important to very important).

The statements made in the course of expert interviews frequently project a different picture concerning intercultural competence and command of English. The following interview excerpts are typical in this regard:

Interviewer: Now let us turn to a subject that we have also been giving thought to and on which the BDEW members' evaluations vary quite a bit. In your view, should it be self-evident for a university graduate to have a good command of a foreign language, both spoken and written?

Expert: Good English is actually a sine qua non. The technical terminology being in English, how is someone going to work with it if unable to grasp it? I see mastery of English as a foreign language as essential for a business education, for tackling and understanding the study literature.

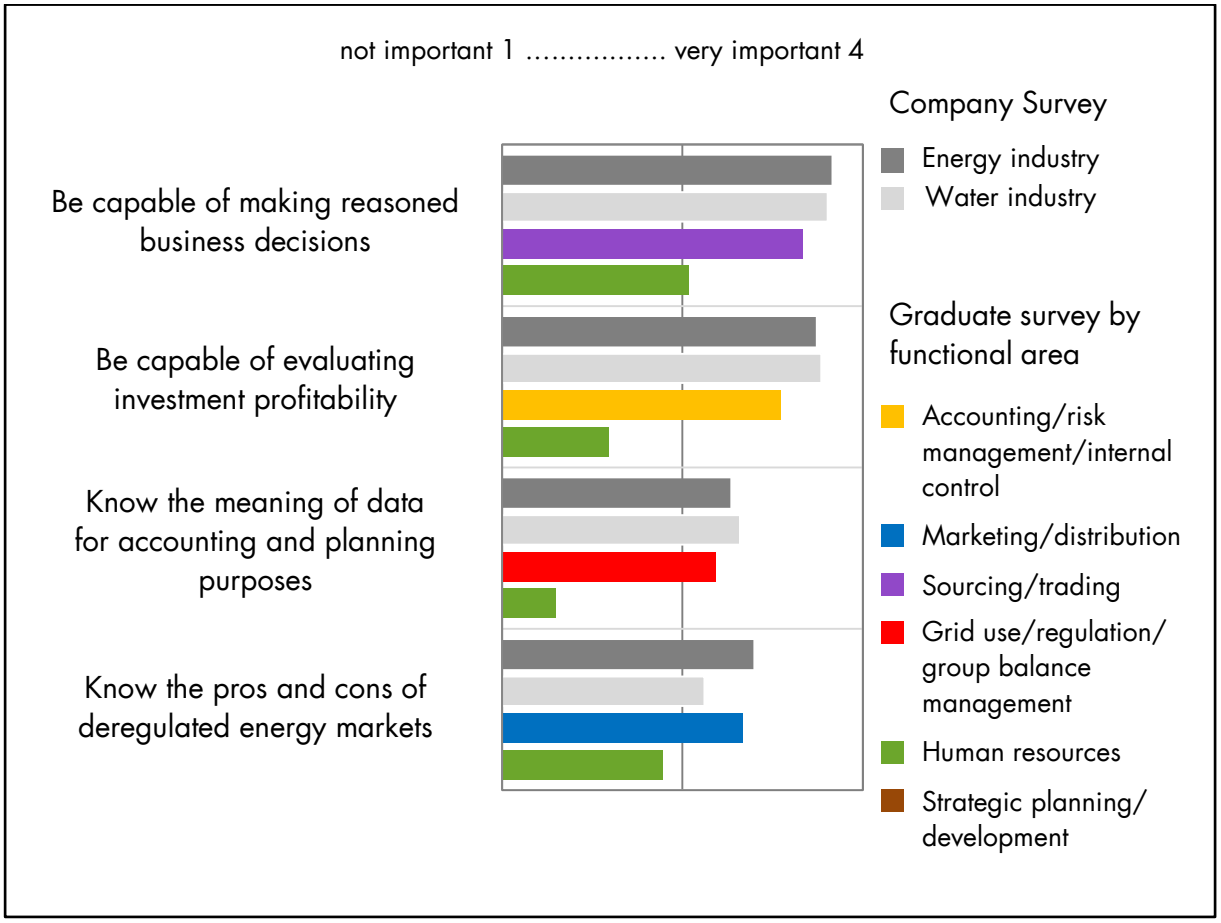
Interviewer: And what about the soft skills area? Is that an important subject, i. e., problem solving ability, team spirit, intercultural competence?

Expert: I think it is particularly important to have this intercultural sensitivity. The issue of being able to open up emotionally is just as important as knowledge. And, something we already touched on earlier, there is the language prerequisite. If I cannot express myself then an important basic requirement is lacking.

Economics

All of the study groups (companies and graduates) rate knowledge and expertise in the subject area of economics as important to very important. Figure 11 shows how the study groups evaluate the importance of individual items in this area.

Figure 11: Economics: Importance of individual items



- The item *"be capable of making reasoned business decisions"* is rated as very important by both the energy companies (MV = 3.74) and the water industry companies (MV = 3.71). University graduates working in the sourcing/trading area (MV = 3.50) rate the item as important to very important. The lowest mean value was calculated for graduates employed in human resources (MV = 2.56). They rate the item as less important to important.
- The item *"be capable of evaluating profitability of investments"* was rated as very important by the energy companies (MV = 3.61) and the water industry companies (MV = 3.66). Clear differences in rating the importance of this item

emerge from the graduate survey. Graduates in the accounting/risk management/internal control area (MV = 3.32) rate the item as important; graduates in human resources (MV = 1.89) rate the item as less important.

- The item *"know the meaning of data for accounting and planning purposes"* is rated as important by both the energy companies (MV = 2.90) and the water industry companies (MV = 2.98). Graduates active in the grid use/regulation/group balance management (MV = 2.78) similarly rate the item as important. In contrast, graduates in the human resources functional area (MV = 1.44) rate the item from not important to less important.
- The item "know the pros and cons of deregulated energy markets" is rated as important by the energy companies (MV = 3.09) and by the water industry companies (MV = 2.68). Graduates in the marketing/distribution functional area (MV = 3.00) also regard this knowledge as important, while graduates working in human resources (MV = 2.33) rated the item as less important.

Overall, a differentiated picture emerges for the economics subject area. While the energy and water industry companies consistently rate it as very important, the graduates for the most part rate it from less important to important. The lowest mean values for all items are registered by graduates active in the human resources functional area. In many cases, they rate knowledge, skills and competencies in the economics area as less important.

The interview partners typically describe the economics expertise required of university graduates like this:

Interviewer: First, we want to address the changes occurring in the industry itself and their impact on functional business areas, on the activities of business people, particularly of university graduates. In your view, how have the functional areas changed for the graduates in the light of these industry trends during recent years and how has this affected the requirements?

Expert: Let's start with the finance side: business control, setting up flexible planning systems that can simulate scenarios, that can relatively quickly produce scenarios on

demand, these are very important topics today and ones that I believe were not yet called for a decade ago. We face financial challenges, particularly in the area of the power grid because of revenue caps. How do I construct an investment calculation for grid investments, is it even possible, how do I calculate that? Is there even a way to finance this investment? These are all questions that a university graduate should be capable of answering.

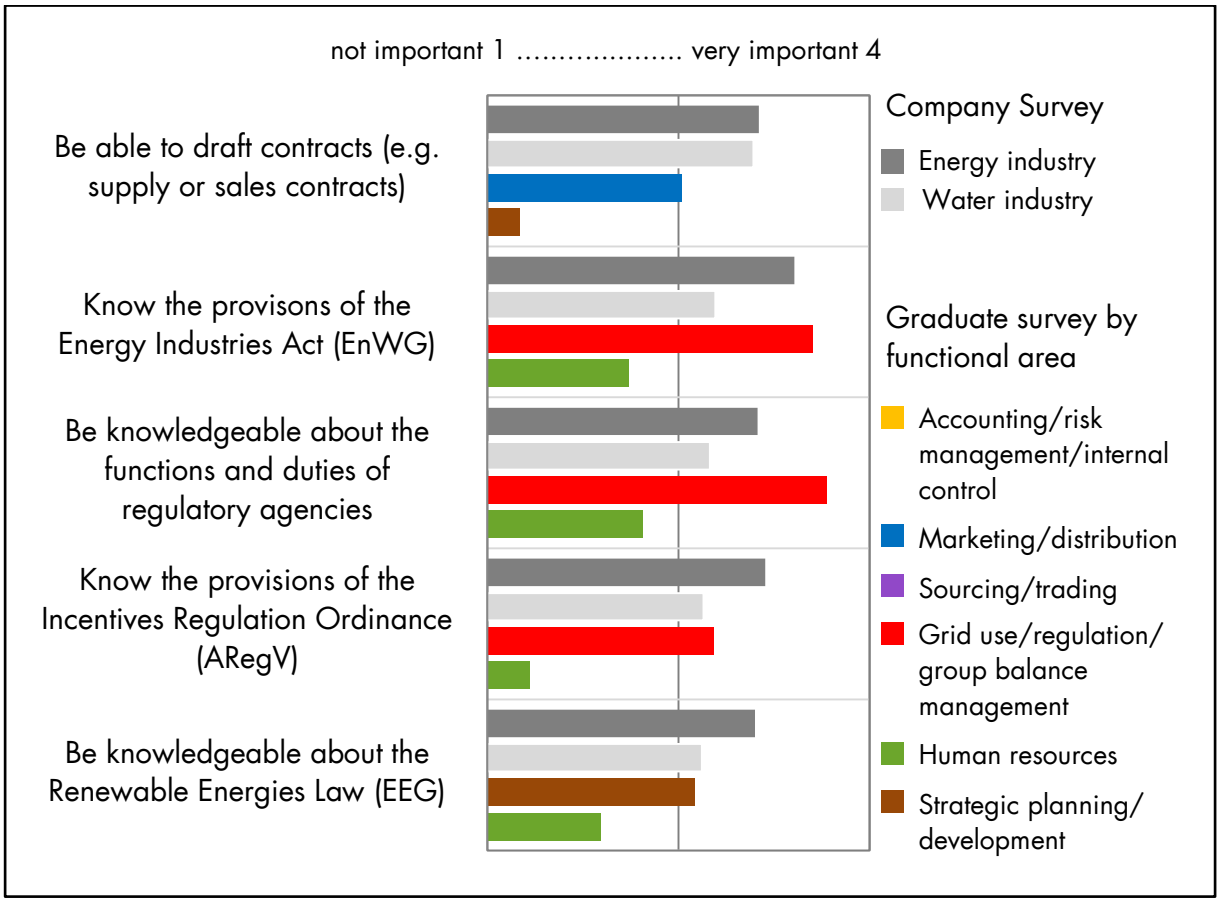
Interviewer: We want to delve a little deeper into this required economics knowledge. We found in the written company survey as well as in the interviews that profitability concerns are of much greater important than formerly. A range of scenarios is computed for every investment to determine if the investment will pay off. How do you assess this? Do the graduates have to master this?

Expert: Absolutely. Anyway, these are already basic issues today. These are amortization calculations. This has to become ingrained.

(Energy) law

Earlier, we showed that the energy and water industry companies rated knowledge, skills and competencies in the subject area of (energy) law as more important than did the graduates. Figure 12 depicts the findings for the individual (energy) law items.

Figure 12: (Energy) law: Importance of individual items



- The item *"be able to draft contracts (e.g. supply or sales contracts)"* is rated as important by the energy companies (MV = 3.13) and water industry companies (MV = 3.09) alike. Clear differences in importance ratings are found in the graduate survey study groups. The highest mean value derives from the marketing/distribution functional area (MV = 2.53). Graduates in this area rate the item as important. The lowest mean value results for graduates in the functional area strategic planning/development (MV = 1.25). They rate this item as not important.
- The energy companies (MV = 3.41) rate the item *"know the provisions of the Energy Industries Act (EnWG)"* as important to very important and the water industry companies (MV = 2.79) rate it as important. Knowing the EnWG receives a particularly high ranking from graduates working in the functional area of grid use/regulation/group balance management (MV = 3.56), who rate it as

very important. In contrast, graduates in the human resources area (MV = 2.11) consider it to be less important.

- The *item "be knowledgeable about the functions and duties of the regulatory authorities"* rates as important with the energy companies (MV = 3.12) and the water industry companies (MV = 2.75). Rankings by the graduates for this item cover the gamut. Graduates in the functional area grid use/regulation/group balance management (MV = 3.67) rate the item as very important, while graduates working in human resources (MV = 2.22) rated it as less important.
- The item "know the provisions of the Incentives Regulation Ordinance (ARegV)" is rated as important by the companies (energy companies, MV = 3.18; water industry companies, MV = 2.70). The graduates assign various ratings to the item. Graduates in the grid use/regulation/group balance management area (MV = 2.78) yield the highest mean value. They rate the item as important. Graduates active in the human resources functional area (MV = 1.33) rate is as not important to less important.
- The item *"be knowledgeable about the Renewable Energies Law (EEG)"* was rated as important by the energy companies (MV = 3.10) and by the water industry companies (MV = 2.68). Knowing the EEG is considered important especially by graduates in the strategic planning/development functional area (MV = 2.63). Contrasted with this, graduates in the human resources functional area (MV = 1.89) rated knowing about the EEG as less important.

The energy and water industry companies consistently rate knowledge and expertise in the (energy) law subject area as important. Frequently, graduates rate the items clearly as less important. Exceptions to this are knowing the Energy Industries Act (EnWG) and knowing the functions and duties of the regulatory authorities. Graduates employed in the grid use/regulation/group balance management functional area, for example, rate these items as very important, actually rating them as more important than do the companies.

Typically, the experts had the following to say during the interviews:

Interviewer: Also of interest to us are the legal aspects. Should the degree programs cover energy law, in addition to general legal matters? Or is that too much specialization, since you have in-house lawyers for this, so that you do not expect it from a university graduate with a major in economics?

Expert: Yes, an interesting question. Having had some exposure to the energy law would definitely be a plus in a hire. It is not so much about knowing every little detail of the energy law, rather about the mechanism of how energy law "originates" and how it then has to be implemented. Another important subject is the influence of European law on the respective national legislation.

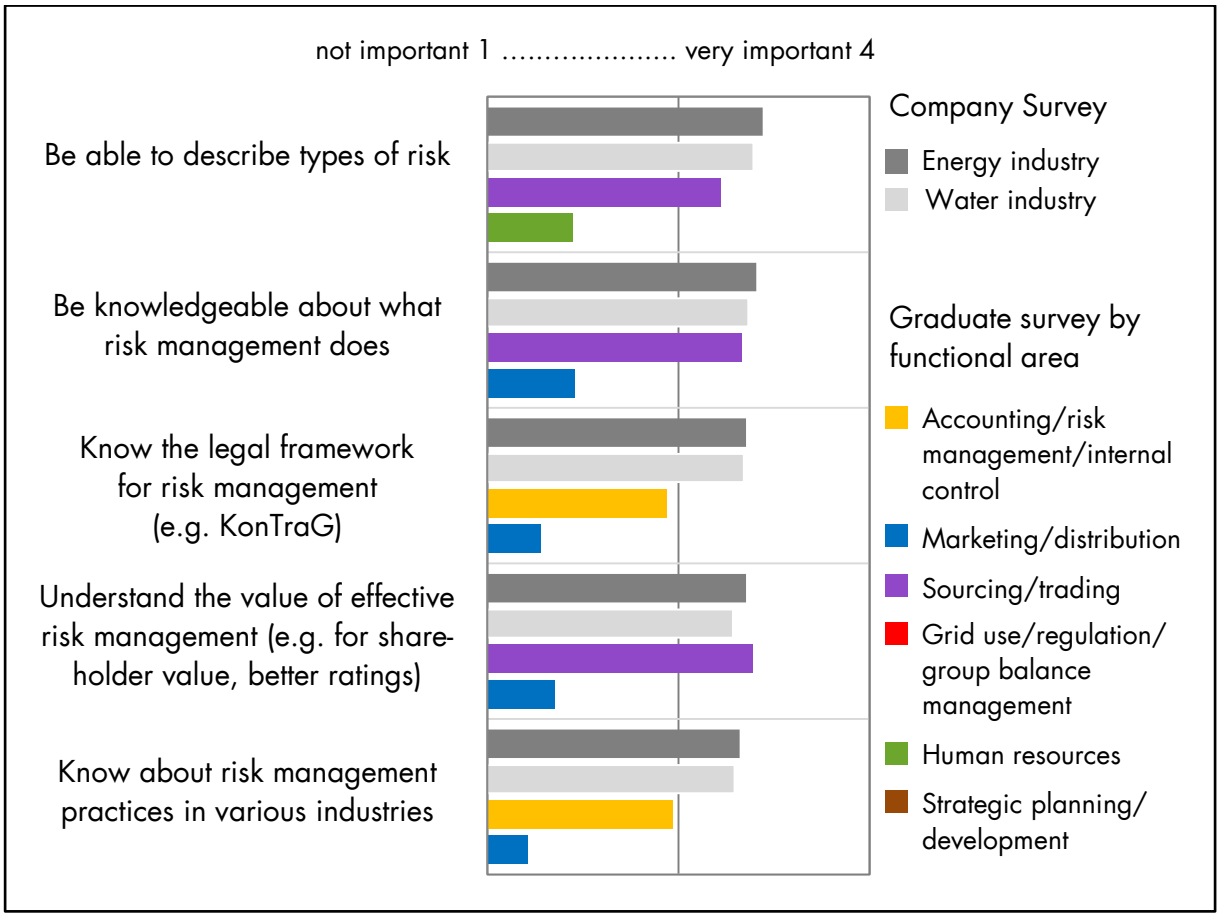
Interviewer: You mention the changed legal frameworks in particular. How extensive a knowledge of legal matters do today's business people need?

Expert: Business people today of course must have basic knowledge of the law; they have to be able to read and understand a law. As I see it that is understood, since so much of the "art" of business is subject to laws. Not being able to grasp them means not being able to apply them; in turn, that means not being able to work in a business-like manner.

Risk management

Knowledge and expertise in the risk management subject area is rated as more important by the companies than by the surveyed university graduates (see also Chapter 3). Figure 13 (next page) shows the importance of individual risk management items for each of the study groups.

Figure 13: Risk management: Importance of individual items



- The energy companies (MV = 3.16) and the water industry companies (MV = 3.09) regard ability to *"describe the types of risk"* as important. The graduates in the functional area sourcing/trading (MV = 2.83) also rate the item as important. The lowest mean value comes from graduates working in human resources (MV = 1.67); they rate the item as less important.
- The item *"be knowledgeable about what risk management does"* was rated as important by the companies (energy companies, MV = 3.11; and the water industry companies, MV = 3.05). The graduates in the functional area sourcing/trading (MV = 3.00) also rate the item as important. Graduates working in marketing/distribution (MV = 1.68) judge such knowledge as not important to less important.
- The item *"know the legal framework for risk management (e.g. KonTraG)"* is rated as important by both the energy companies (MV = 3.03) and the water industry companies (MV = 3.01). Graduates in all the functional area put a

lesser value on the importance of these items. The highest mean value derives from graduates employed in the accounting/risk management/internal control functional area (MV = 2.41). They estimate the item as being less important to important. In contrast, graduates employed in marketing/distribution (MV = 1.42) rate the item as not important to less important.

- The ability to *"understand the value of effective risk management (e.g. for shareholder value, better ratings)"* is rated as important by the companies (energy companies, MV = 3.03; water industry companies, MV = 2.93). The graduates once again yield distinctly different ratings. Thus, graduates working in the sourcing/trading functional area (MV = 3.08) rate the item as important. In contrast to this, graduates in the marketing/distribution functional area (MV = 1.53) rate this ability as not important to less important.
- The item *"know about risk management practices in various industries"* is rated as important by both the energy companies (MV = 2.98) and the water industry companies (MV = 2.94). Graduates in the functional area accounting/risk management/internal control (MV = 2.45) rate the item as less important to important, while graduates employed in marketing/distribution (MV = 1.32) rate the item as not important to less important.

Overall, a differentiated picture emerges from the risk management subject area as well. While the energy and water industry companies consistently rate the individual items in this subject area as important, the graduates here estimate the importance of knowledge, skills and competencies differently. Graduates active in the functional areas of sourcing/trading and accounting/risk management/internal control for the most part rate the individual items as important. Graduates employed in the functional areas of marketing/distribution and human resources judge these items not important to less important.

A number of the experts commented on the subject of risk management, as follows:

Interviewer: The written company survey showed that the subject of risk management has assumed a much greater importance. What specifically does a university graduate have to bring to the table by way of knowledge in this area?

Expert: Right after deregulation, we set up our own trading subsidiary, which by now has done more than five billion in business. We were aware right from the start that there were such concepts as risk management, risk monitoring and risk control, but we had no notion how to go about them, nor did we have the people for it. What we needed was skills from the banking environment, risk analysts; in other words, we needed skill profiles that we had no idea about then but that today are elementary. To give another example, we also invest heavily outside the country. There we are moving not just in the domestic market that we understood pretty well, but suddenly we have to act in foreign markets where the risks have to be gauged. These are completely new management challenges.

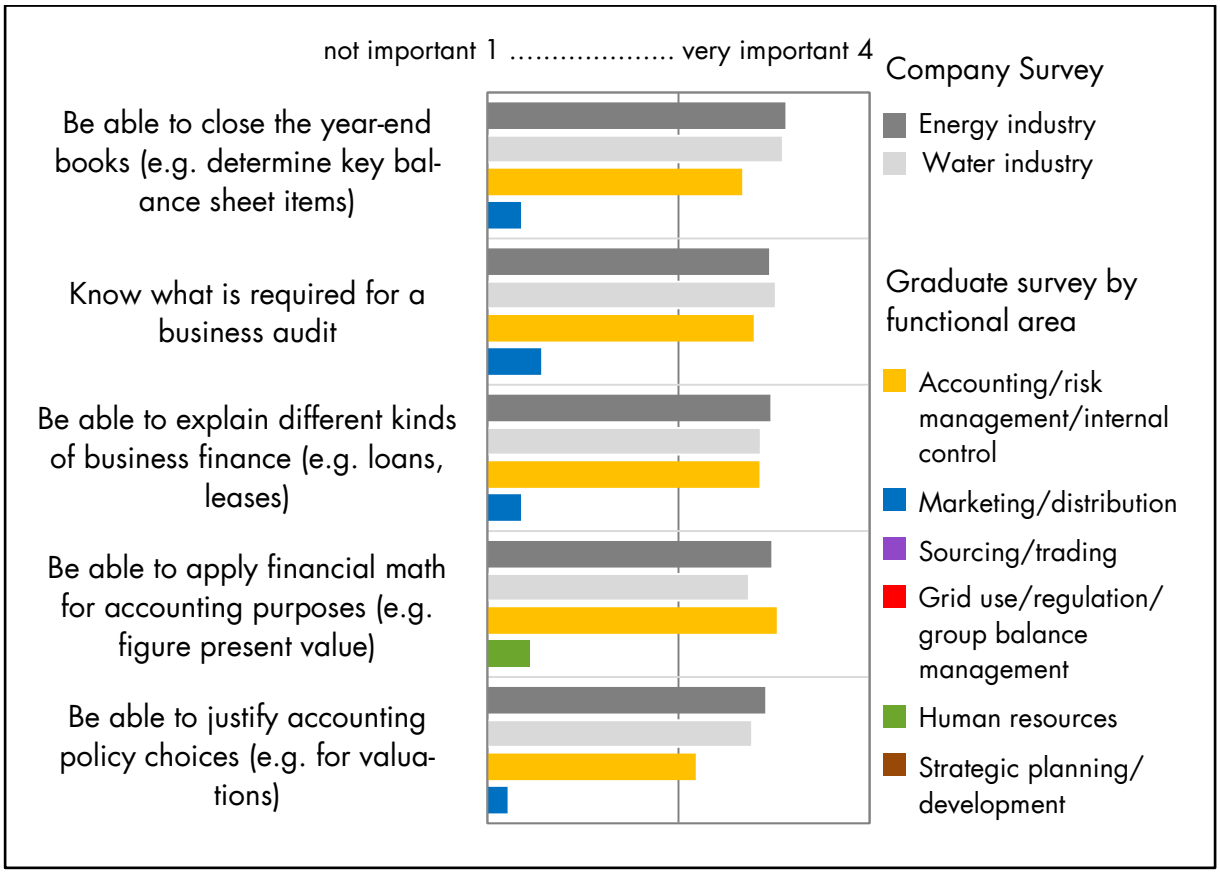
Interviewer: The subject of risk management seems to have taken on a completely new dimension. At least that is what we have heard from most experts. What risk management skills does a graduate have to have because of this?

Expert: If I want to participate for a billion in a North Sea wind farm, I have to know how to do a profitability analysis and how to evaluate the risk. How do I protect against those risks? This involves legal and financial business considerations. It is highly complex.

International accounting

We previously highlighted that the companies in the energy industry and the water industry judge knowledge, skills and competencies in the subject area of international accounting as more important by far than do the graduates. Figure 14 below presents a differentiated picture of the individual item ratings.

Figure 14: International accounting: Importance of individual items



- Ability to *"close the year-end books (e.g. determine key balance sheet items)"* was rated as important by the companies (energy companies, MV = 3.34; water industry companies, MV = 3.32). The graduates by functional area once again yield distinct differences. Thus, graduates working in the accounting/risk management/internal control functional area (MV = 3.00) rate this item as important, while graduates in the marketing/distribution realm (MV = 1.26) rate the item as not important.
- The item *"know what is required for a business audit"* is rated as important by both the energy companies (MV = 3.21) as well as the water industry companies (MV = 3.26). Graduates in the functional area accounting/risk management/internal control (MV = 3.09) judge the item to be important. In contrast, graduates employed in marketing/distribution (MV = 1.42) rate the item as not important to less important.
- *"Be able to explain the different types of business finance (e.g. loans, leases)"* is rated as important by the companies (energy companies, MV = 3.22; water in-

dustry companies, MV = 3.15). The graduates once again yield distinct differences regarding importance. Thus, graduates in the accounting/risk management/ internal control functional area (MV = 3.14) rate this item as important. In contrast, graduates in the marketing/distribution area (MV = 1.26) rate the item as not important.

- The item *"be able to apply financial math for accounting purposes (e.g. to calculate present value)"* is rated as important by the energy companies (MV = 3.23) as well as the water industry companies (MV = 3.05). Graduates working in the functional area accounting/risk management/internal control (MV = 3.27) also rate the item as important. The lowest mean value comes from graduates working in human resources (MV = 1.33), who rated the item as not important to less important.
- The *item "be able to justify accounting policy choices (e.g. for valuations)"* is rated as important by both the energy companies (MV = 3.18) and the water industry companies (MV = 3.08). Graduates working in the functional area accounting/risk management/internal control (MV = 2.64) also rated the item as important. Graduates employed in marketing/distribution (MV = 1.16) by contrast rated the item as not important.

The bottom line is that knowledge and expertise in the international accounting area are important for the surveyed companies. The results of the graduate survey show that these capabilities are rated consistently as important by graduates active in the accounting/risk management/internal control functional area. Graduates employed in the functional areas of marketing/distribution and human resources for the most part judge these items as not important to less important.

In the interviews, the experts have the following to say about the need for international accounting:

Interviewer: Lately, there has been quite a bit of discussion on the subject of international accounting, some of it controversial. What role does international accounting play for you currently, and do businesspeople have to master international accounting or should they at minimum be familiar with it in the future?

Expert: We just signed a billion Euro refinancing and the banks require international accounting. So, without an IFRS degree, it is not possible to put a financing together; that is, if you want to play in a certain league, say you want to finance large projects, you just cannot do without an international degree. The graduates have to come prepared.

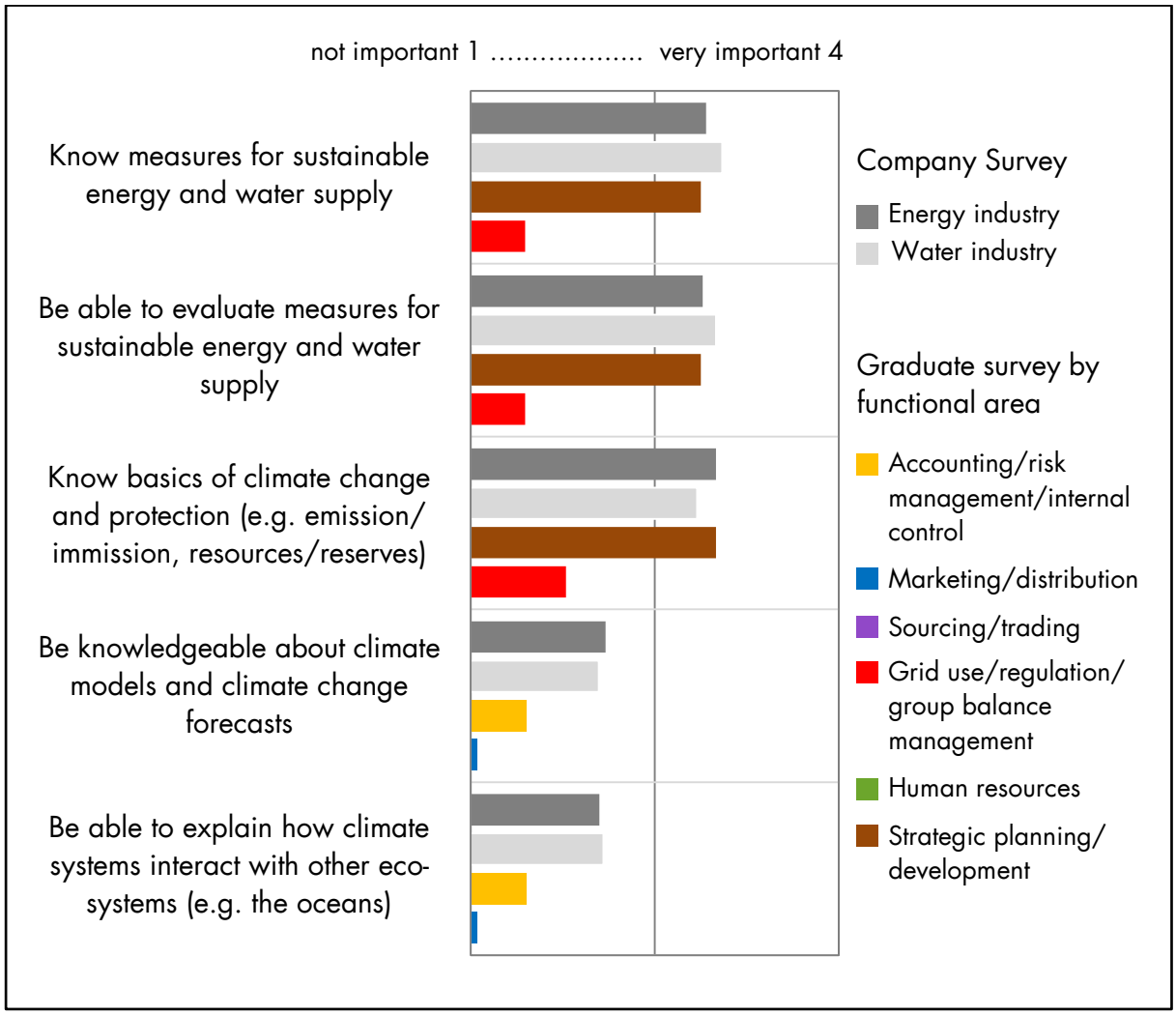
Interviewer: We are quite interested in international accounting. But there is a wide difference of opinion.

Expert: Although we are not a big company, we do international accounting. The gap between our German Commercial Code and the IFRS is closing since the Accounting Law Modernization Act was passed, and my advice is that everyone in business had better know international accounting.

Ecology and Sustainability

Knowledge and expertise in the subject area of ecology & sustainability is rated for the most part as less important (also see Chapter 3) by those surveyed in all three study groups (energy companies, water industry companies, graduates) when compared to the other areas (soft skills, economics, (energy) law, risk management, international accounting and technology). Figure 15 below depicts how important individual items in the ecology & sustainability area are as judged by the study groups.

Figure 15: Ecology & sustainability: Importance of individual items



- The item *"know measures for sustainable energy and water supply"* is rated as important by the companies (energy companies, MV = 2.92; water industry companies, MV = 3.05). The graduates working in the strategic planning/development functional area (MV = 2.88) also judge it to be important. On the other hand, graduates working in the grid use/regulation/group balance management functional area (MV = 1.44) rate this item as important as not important to less important.
- *"Be able to evaluate measures for sustainable energy and water supply"* is rated as important by the energy companies (MV = 2.89) as well as by the water industry companies (MV = 3.00). The graduates once again reflect a differentiated picture. Graduates employed in the strategic planning/development functional area (MV = 2.88) regard this item as important, while the graduates

in the grid use/regulation/group balance management (MV = 1.44) rate the item as not important to less important.

- *"Be knowledgeable about basics of climate change and protection (e.g. emission/immission, resources/reserves)"* is important to the companies (energy companies, MV = 3.00; water industry companies, MV = 2.84). This also applies to graduates working in the strategic planning/development functional area who account for the highest mean value (MV = 3.00) among graduates. The lowest mean value was registered for graduates in the grid use/regulation/group balance management functional area (MV = 1.78). They rate the item as less important.
- The item *"be knowledgeable about climate change models and climate change forecasts,"* unlike any of the items up to this point, is rated as distinctly less important by all eight study groups. Where the companies rate the item as less important (energy industry, MV = 2.10); water industry, MV = 2.04), the graduates rate it throughout as not important to less important. The highest mean value originates with the graduates working in accounting/risk management/internal control (MV = 1.45); they rate it as not important to less important. It is rated as not important by graduates working in the marketing/distribution functional area (MV = 1.05), thus recording the absolutely lowest mean value for this item.
- *"Be able to explain how climate systems interact with other ecosystems (e.g. the oceans)"* overall is rated – like the preceding item – as less important by all study groups. The energy companies (MV = 2.05) and the water industry companies (MV = 2.08) rate it as less important. The graduates who work in the accounting/risk management/internal control functional area (MV = 1.45) rate it as not important to less important and those in marketing/distribution (MV = 1.05) judge it to be not important.

Analysis of the individual items for ecology & sustainability makes clear that, knowledge and expertise in this subject are regarded as less important by all the study

groups compared to the other subject areas. A number of items (e.g. "know measures for sustainable energy and water supply" and "be able to evaluate measures for sustainable energy and water supply") are rated as important both by the companies and the graduates working in the strategic planning/development. Conversely, the graduates in the grid use/regulation/group balance management rate them as not important to less important. Other items, (such as "be knowledgeable about climate models and climate change forecasts") are judged less important by the companies and as not important to less important by the graduates.

The interviewees had the following to say on the subject of ecology & sustainability:

Interviewer: I would like to touch on another area, that has been implicit but has not been made a subject explicitly, and that is the subject of ecology & sustainability. How important is knowledge of this subject for graduates if they want to work in your industry?

Expert: I always find myself a bit at odds with these terms. It does not make any sense at all to me that everybody all of a sudden acts as if ecology is something that needs to be singled out. The same is true of the term sustainability. The gas industry can rightfully claim to have always acted in sustainable fashion, from the start, because we looked far into the future and explored the consequences. That should be self-evident.

Interviewer: Do you expect university graduates to confront the issues of ecology and sustainability?

Expert: If someone aspires to leadership responsibility in an enterprise, be it on the economics side or whatever other side, and lacks the fundamental orientation of assuming responsibility for the here and now and for the future, which is what sustainability and ecology basically are all about, then that person is not a good fit.

Analysis of individual items in the subject areas soft skills, economics, (energy) law, risk management, international accounting as well as ecology & sustainability, taking into account the various functional areas of the university graduates, leads to findings

that are clearly more differentiated than when examining each of the respective subject areas as a whole.

The majority of items are rated as less important by the university graduates in all functional areas compared to the companies. There is, however, also a series of items for which the highest mean value of the university graduates lies above the companies' mean values, while on the other hand the university graduates' lowest mean values also clearly lie below those of the companies. In some instances, differences of as much as 1.9 scale units emerge between the six graduate study groups in their ratings of an item's importance. The graduates of a given functional area may rate the item as important to very important, while graduates from another functional area rate the item as not important. The estimated relevance of different kinds of knowledge, skills and competencies for professionals in the energy and water industries depends heavily in that case on which particular functional area the test subject works in. At the same time, it is clear that the surveyed university graduates, as distinct from the companies and experts, view education more from an individual (and less from an organizational or strategic perspective, for example). If so, this survey provides a valuable corrective to the usual depictions of industry's educational needs and the resulting, mostly abstractly formulated, demands for personnel and training on employees and managers. Beyond that, the study, by juxtaposing a variety of views and ratings perspectives, gives empirical research standards their proper due.

The next chapter hones in on the results of the spoken survey.

3.2 Results of the spoken survey

3.2.1 Method

As explained previously, the study is designed to allow analyzing educational requirements for university business graduates in the energy and water industries from multiple perspectives. The results of the written surveys presented in Chapter 3.1 make up only one facet, albeit a very important one, of the problem in question: the views of the companies and graduates, captured by means of standardized tools. These pers-

pectives need to be clarified, complemented or, as it were, contrasted with statements from in-depth interviews with industry experts. Of particular importance are patterns in the expert answers here; causal explanations of certain phenomena, that can only be captured in a limited way with standardized tools; the articulated relationships between changes in the business environment; qualification requirements; necessary knowledge and expertise and changed or changing study program content. The interview excerpts presented in chapter 3.1 show that the experts have differentiated perceptions, preconceptions and "subjective theories" regarding these phenomena and relationships, that, moreover, absolutely diverge from the assessments in the written company survey.

Analysis of the in-depth interviews concentrated on the subject areas of risk management, ecology and sustainability as well as meta-competencies (soft skills). The choice of these subject areas was not made arbitrarily, but rather, was a key result of studies done to date that strongly emphasized the importance of these areas for a university curriculum to be developed for industry.

In the written survey, educational requirements for the risk management area are judged important to very important across all categories and company sizes. On the one hand, the experts reinforce this judgment; on the other, they provide additional information during the interviews to flesh out this area that are highly useful for curriculum development.

Demands on graduates with respect to ecology and sustainability received varied assessments in the written survey and were, in part, judged "less important." In evaluating the interviews, we sought to question this assessment critically and analyze reasons for the broad spectrum of answers in this subject area. This is also and especially happening against a backdrop of current political discussions concerning the so-called "energy transition" that will undoubtedly be of growing importance for ecology and sustainability in all sectors and for the entire industry.

Meta-competencies have a prominent place in both the written and the spoken surveys. By far, most of the meta-competencies captured in the questionnaires were rated as

very important. Furthermore, during the interviews, the experts brought up many other meta-competencies that they judged to be very important. At the same time, however, they pointed out what deficits in them they see in the university graduates.

The Atlas.ti software package[5] was used to support analysis of the transcribed expert interviews. The semantic networks that the application outputs in graphic form were then analyzed in light of the following questions:

- Does the response behavior exhibit any sector and/or company size-related features?
- What answer patterns can be identified in the statements of the experts? In which question contexts do these patterns surface and how do they vary?
- What rationales, explanations and relationships (causal, final) are central to the experts' arguments?
- To what extent do the expert statements correspond to the results of the written survey?
- What additional information do the interviews provide over and above what is in the written survey?

Excerpts from the answers to these questions, respectively the analysis findings, are presented and commented using the following scheme:

- Description of the semantic networks (including but not limited to the number of expert comments, the allocated statements, content-related and structural answer patterns, sector- and company size-related features).
- Comparison with the results of the written survey: the network data and the results of the written survey are compared, interpreted and discussed with a view to developing a curriculum for a university-level program of studies.

[5] Atlast.ti software is used in conjunction with content analysis. It allows structuring captured data, setting up relationships and creating semantic networks. The network nodes symbolize the categorized statements. The links represent the relationship between the nodes, respectively the statements.

3.2.2 Risk management findings

Altogether 23 experts in the energy and water industries commented extensively on risk management. The statements coded, their contents analyzed and depicted in the following networks were 96 in number. Figures 16 and 17 (following pages) show semantic networks for relevance of risk management in the energy and water industries and for the requirements, as formulated by the experts, for university business graduates in this subject area.

The networks were evaluated with regard to content-related as well as structural answer patterns. In order to assure the comparability of the expert comments and to allow their interpretation, the individual statements were coded, i.e. they were categorized[6], sorted by content and color coded.

The portions of the networks colored the same in the diagrams assemble those aspects that, according to the experts, played a special role in the subject area. Besides general statements on the relevance of risk management (colored green), these include descriptions of how the subject area is established in the firm (blue), why and with what objectives risk management is practiced (orange), which risk types need to be managed in the firm, in the sector and/or in the industry (pink) and what demands on university graduates these give rise to (yellow). In their statements, the experts refer to a multiplicity of risks. The stress that financial risks preponderantly originate from market risks, such as those incurred from trading quantities and individual currencies. Derivatives risks are often mentioned in connection with production, liquidity and insolvency risks. The experts also see numerous, additional political and legal risks that must be taken into account in the business process. Aside from purely regulatory risks, risks deriving from the Federal Government's energy concept (e.g. exploitation of renewable energies) receive special mention.

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[6] Category here stands for the content aspect and comprises all of the expert comments on this aspect, e.g. "Risk management is important." The expert statements can vary from single words to whole sentences or even entire passages of text. The categories are represented by the nodes in the network diagram.

Figure 16: Relevance of risk management to the energy and water industries

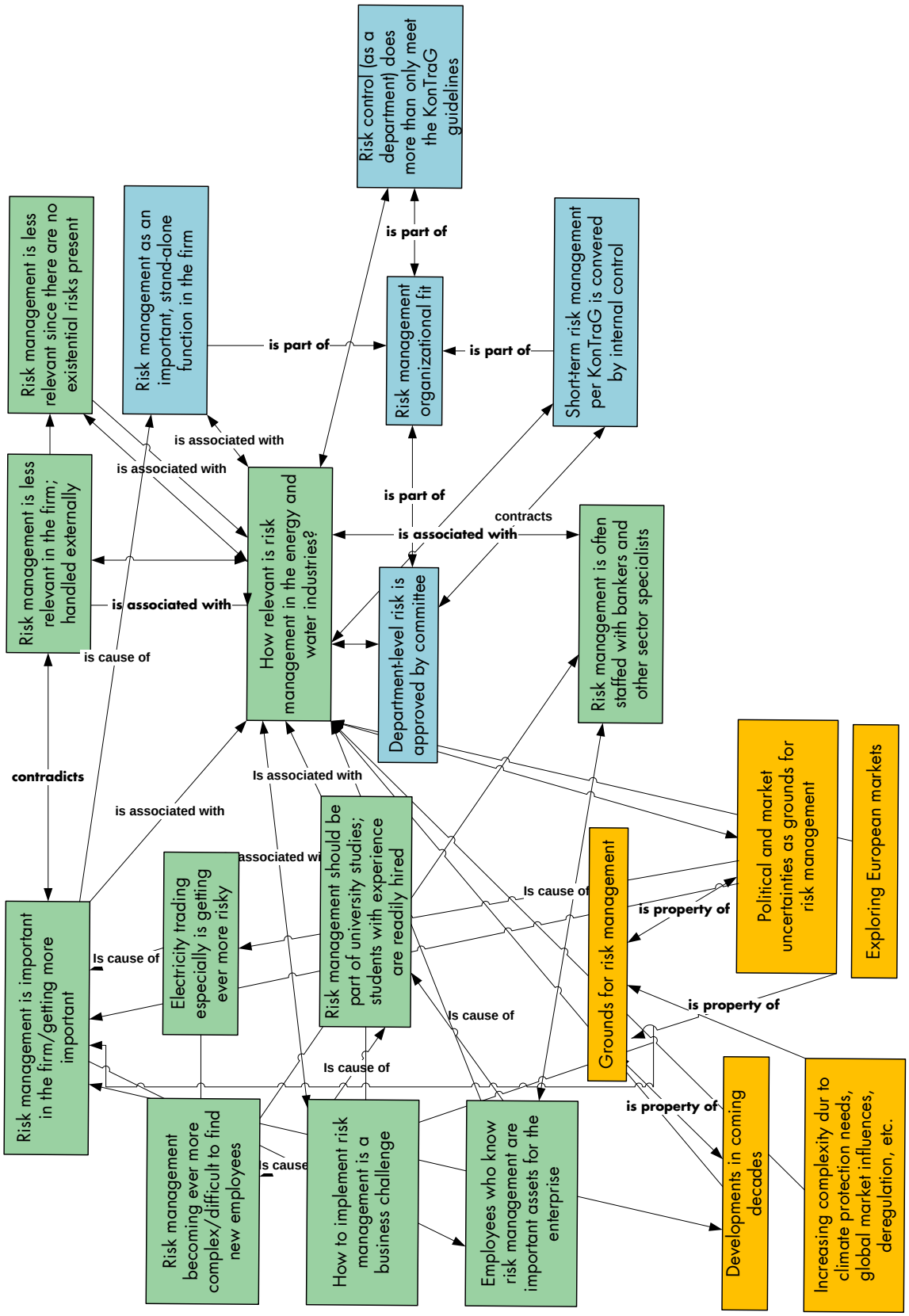
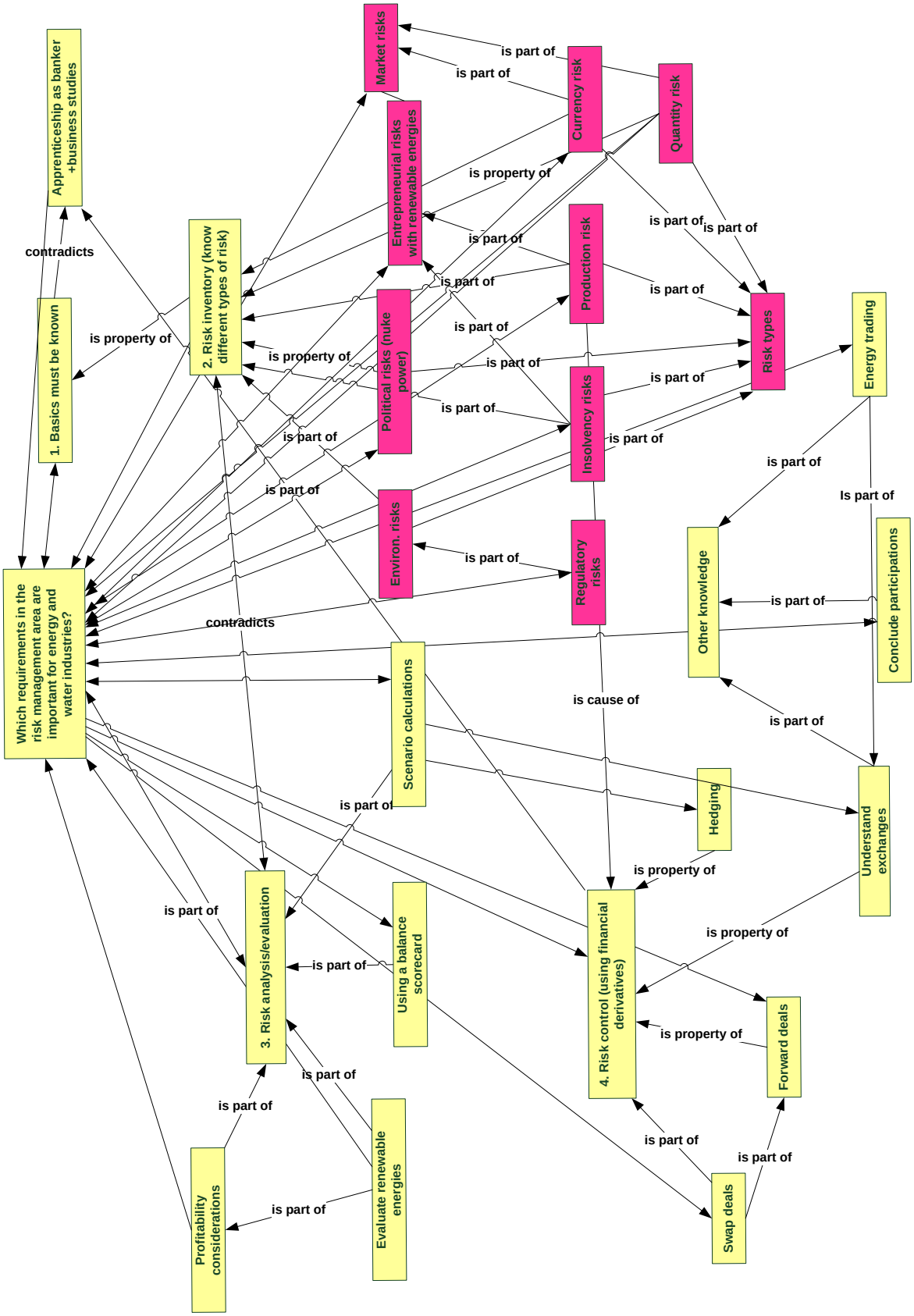


Figure 17: Risk management-related requirements for university graduates



About half of the 96 analyzed expert statements refer to educational requirements for young graduates. In this, the statements follow a specific (structural) chain of arguments, as shown in Table 2.

Table 2: Structural answer patterns for risk management

Number	**Short description**
Answer pattern 1	Relevance – reasons – organization of the firm – requirements
Answer pattern 2	Relevance – reasons – requirements
Answer pattern 3	Relevance – organization of the firm – requirements
Answer pattern 4	Organization of the firm – requirements
Answer pattern 5	Reasons – requirements
Answer pattern 6	Relevance – reasons

In particular, there are six characteristic answer patterns, each of them employed by several experts. These patterns are differentiated by the length of the argumentation chain. The contents (e.g. the reasons why risk management is relevant and what it requires of university business graduates) on the other hand are in many cases identical. We introduce answer pattern 1 below by way of example. This is supplemented by going into anomalies and distinctive features in the answer patterns (for example, answer chains that are not consistent throughout, that contain gaps or others that have or that may have particular potential importance for curricular design of a study program).

Answer pattern 1 (Relevance – reasons – organization of the firm – requirements) contains statements about how relevant the subject area is and why, what organizational form it takes in the firm as well as any additional explanations regarding the demands it makes on university business graduates.

- The experts stress not only that risk management is a very important subject area for the energy and water industries, but also give sector-specific grounds for it (e.g. political and market uncertainties, the subject area's growing complexity), and they describe in which form the subject is dealt with in their company (i.e., handled by a dedicated organizational area, by internal control or directly at department level).
- They also articulate practical requirements and their expectation that university business graduates, for example, know how to conduct profitability analyses under various risk assumptions, that they understand hedging; they stress especially that risk management studies should have this kind of content.

It is worth noting that some experts regard risk management as less relevant on the one hand, for example, because an external consultant handles it for their firm. On the other hand, they expect that university graduates be able to conduct a risk inventory and analyze as well as evaluate risk.

Through detailed analysis, we tested to what extent we could identify sector- and firm size-specific special features or differences and commonalities in the expert statements. For this purpose, two networks were set up: a) covering risk management in the energy industry[7] and b) covering risk management in the water industry. In addition: Two networks related to firm size were set up and analyzed: c) for risk management in small and medium-sized firms (SME)[8] and d) for risk management in large enterprises.[9]

In general, it can be affirmed that the statements of experts in the energy industry coincide to a high degree with those in the water industry. Experts in both domains describe risk management in similar fashion as an important subject area. Above all,

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[7] The expert statements from the electricity, gas and district heating sectors or multi-sector firms were evaluated as a group under the network name "energy industry". In the present report, multi-sector designate enterprises active in the electricity, gas or district heating sectors and in another sector as well.

[8] SMEs are firms with annual sales revenues between 10 million to < 500 million €.

[9] Large enterprises are those with annual sales revenues between 500 million € and < 1 billion €.

they justify this on the grounds of political and market uncertainties. Their expectation, that university business graduates in particular be able to analyze, evaluate and control risk, transcends the individual sectors.

The firm size-specific examination also shows extensive parallels in the expert statements. Risk management is regarded as important irrespective of enterprise size. Experts in the KMU as well as those in large enterprises for the most part call for in-house risk management departments and expect graduates to be able to analyze, evaluate and control risks.

Comparison of results from the written survey with those from the interviews shows a high level of agreement in assessing the risk management subject area. Expanding on the written survey, the experts underline that renewable forms of energy in particular bring new and special political risks that must be managed. In the experts' views, for example, changed political circumstances could lead to planned and/or completed investment projects becoming unprofitable or at least putting their profitability into question and requiring validation. These are tasks that university business graduates should be able to perform.

This then is largely how the educational qualifications demanded of university graduates are formulated without regard to sector membership or enterprise scale. At least as far as risk management is concerned, this suggests that a curriculum for industry across the board is possible and meaningful.

3.2.3 Results for Ecology & Sustainability

A total of 22 experts gave their views on ecology & sustainability as well as renewable energy; we coded a total of 157 statements, of which 65 deal with the subject of renewable energy. The content analysis and the network diagrams are summarized in Figure 18 and Figure 19.[10]

[10] Because of the large number of expert statements on renewable energy as well as the special significance this subject carries within ecology and sustainability, we subjected the sub-area "renewable energy" to a separate analysis.

Figure 18: Relevance of ecology and sustainability for the energy and water industries – with requirements for university business graduates

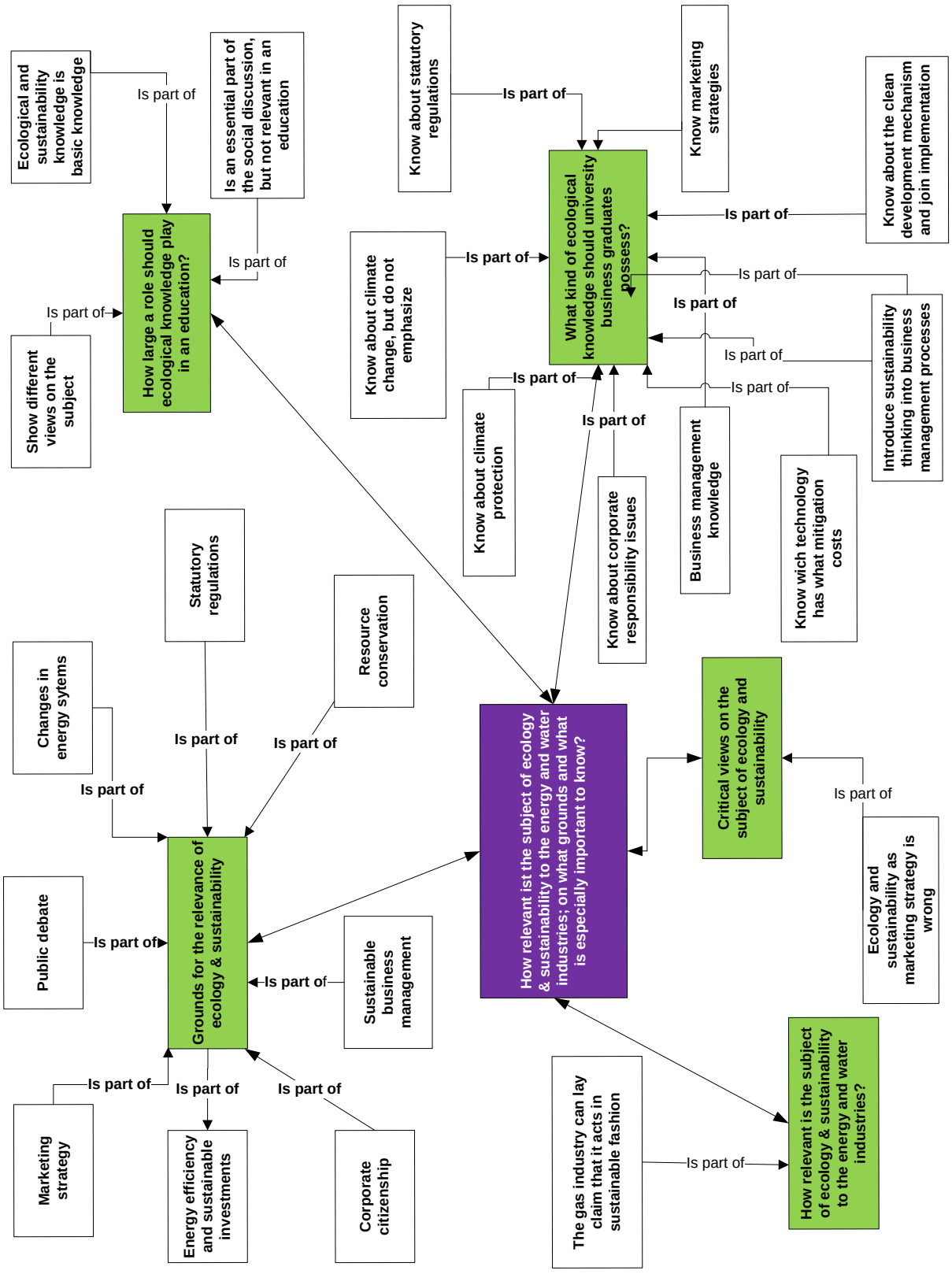
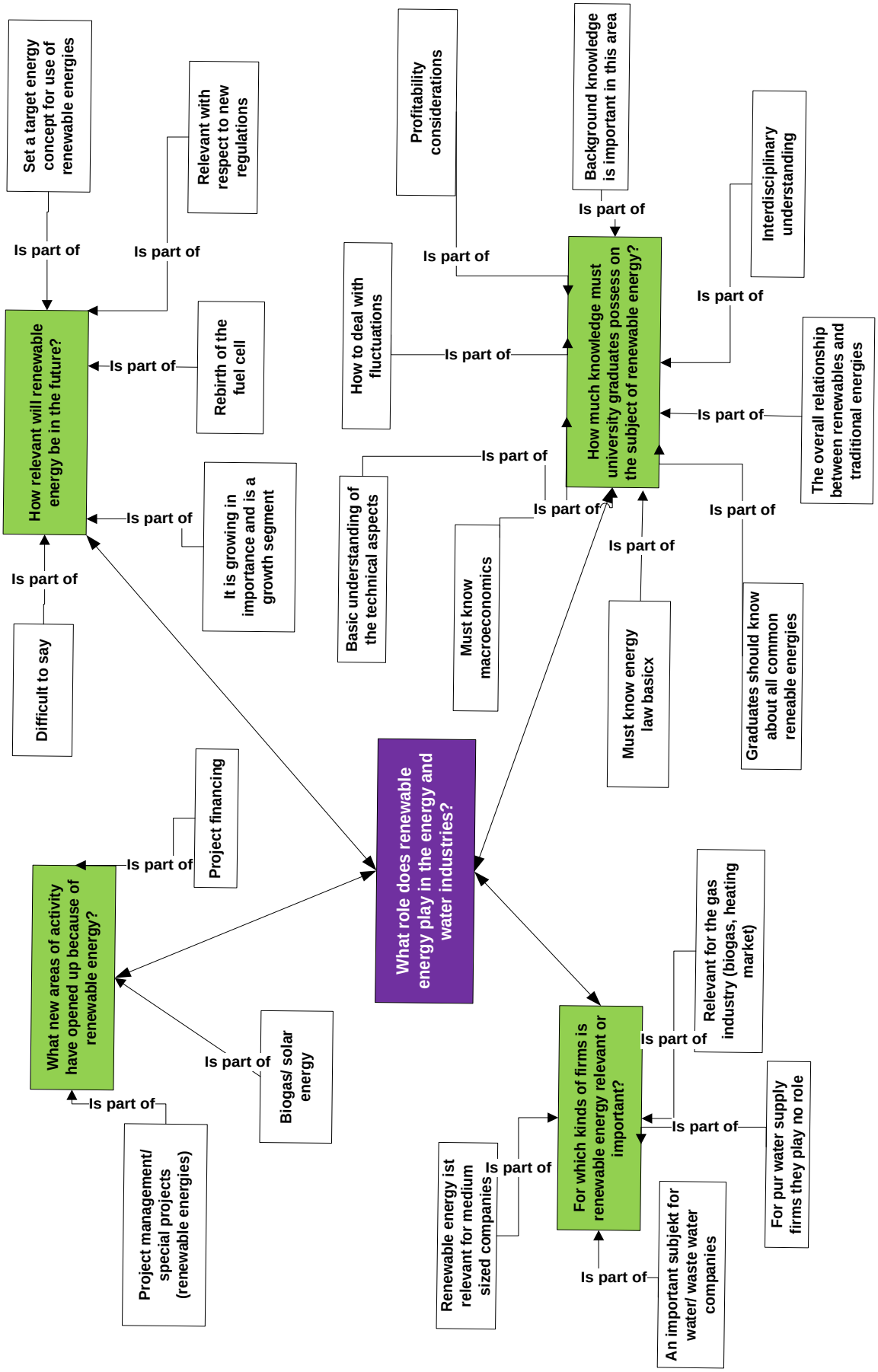


Figure 19: Relevance of renewable energy for the energy and water industries – with requirements for university business graduates



While Figure 18 shows the semantic network for the ecology & sustainability subject area, Figure 19 diagrams the relevance of renewable energy for the energy and water industries and the demands renewable energy makes on university business graduates. Because of the complexity of the theme some statements were omitted.

To ensure the comparability of the expert statements and allow their interpretation, the statements were assembled in categories. The networks are divided into statements a) about the relevance of ecology & sustainability or of renewable energy; b) the grounds for the subject area's relevance; c) the extent to which they should form part of an education; and, d) educational requirements for university business graduates.

The experts, in part, follow specific chains of argument, shown in Table 3.

Table 3: Structural answer patterns for ecology and sustainability

Number	**Short description**
Answer pattern 1	Relevance – grounds – educational object – requirements
Answer pattern 2	Relevance – grounds – requirements
Answer pattern 3	Relevance – educational object – requirements
Answer pattern 4	Relevance – requirements
Answer pattern 5	Educational object – requirements
Answer pattern 6	Relevance – grounds

Table 3 distinguishes six structural answer patterns, which, for the most part, several experts employ and that vary by the length of the argument chain. On the other hand, the contents (e.g. the grounds cited for the relevance of ecology & sustainability and the demands on university business graduates) are in many cases identical. We explain answer pattern 1 below by way of example. This is supplemented by going into anomalies and distinctive features in the answer patterns that have or potentially have particular importance for curricular design of a study program.

Answer pattern 1 (Relevance – grounds – educational object – requirements) contains statements affirming not only that ecology & sustainability as well as renewable energy are relevant topics for the energy and water industries and why that is so; but also the extent to which they should form part of a university education, and what the educational requirements for university business graduates are.

- The experts stress the relevance of ecology & sustainability and justify it in terms of the public debate, corporate citizenship, climate politics and the demands for energy efficiency. They assume that knowledge of this area is necessary, making it imperative to have it be part of a university education.
- However, the experts differ in their statements on the scope of what should be taught in the course of a university education. The spectrum of opinions ranges from basic knowledge from differing points of view on the subject all the way to having it account for ten percent of the total education. Two experts insist that university business graduates should be capable of evaluating the feasibility of planned, eco-oriented projects in the energy and water industries, and they should above all acquire knowledge in the legal sphere (e.g. concerning laws regarding the phase-out of fossil fuels). Other experts stress the importance of renewable energy (solar energy, solar technology and wind energy) and the new businesses that they have given rise to and are continuing to do so. They assess renewable energy as a growth sector and stress that basic knowledge about the different technologies as well as background knowledge (e.g. about financing sources) are must-haves for university graduates. The latter should have the ability, among others, for evaluating the feasibility of projects connected with renewable energy from a profitability standpoint.

Analyzing the interviews makes it clear that the experts recognize the growing importance of ecology & sustainability and expect university graduates to possess knowledge of the subject. However, opinions diverge about the best learning venue for acquiring such knowledge. While some experts see the needed knowledge and skills as unequivocally anchored in a curricular study program, others take the position that

knowledge about climate/climate change should be part of general knowledge acquired in each type of school, i.e. it should not have to be taught at university level.

As part of a detailed analysis, we tested to what extent we could identify sector- and firm size-related special features or differences and commonalities in the expert statements. The sector-specific analysis shows that the statements exhibit both differences and common features. For example, water industry experts stress the high relevance of ecology & sustainability, while some in the energy industry rank it as less important. The grounds for why this subject area is relevant also differ. The gas industry's experts see the public debate as the most important reason why ecology & sustainability are relevant, while the electricity industry's experts highlight the sustainable business operations aspect. The water and waste water companies see the principal reason in statutory regulations.

The experts also express different views regarding requirements for university business graduates. Experts in the gas industry give primacy to business management skills (e.g. profitability analyses), while experts in the electric power industry call for technical knowledge. The water and waste water companies judge having knowledge about statutory regulations and concerning climate protection as especially important.

The size-specific analysis shows differences and commonalities in the expert statements from small, medium and large enterprises. Experts from small, medium as well as large firms cite the subject's importance for managing sustainable businesses as grounds for ecology & sustainability's relevance. Statutory regulation is also uniformly judged to be relevant across all enterprise sizes. Experts from small and large companies cite changes in energy systems and resource conservation as reasons for acting in an ecologically-oriented manner. The experts from medium and large enterprises additionally see ecology & sustainability as having importance for marketing strategy.

Complementing the written data survey, the expert interviews results also show, for example, that a thematic linkage exists between the subject areas of risk management and ecology & sustainability (including renewable energies) that merits consideration in developing any university curriculum. So, for example, in multiple instances, new

risks were mentioned in connection with exploitation of renewable energy that university graduates would have to be able to recognize, analyze and manage.

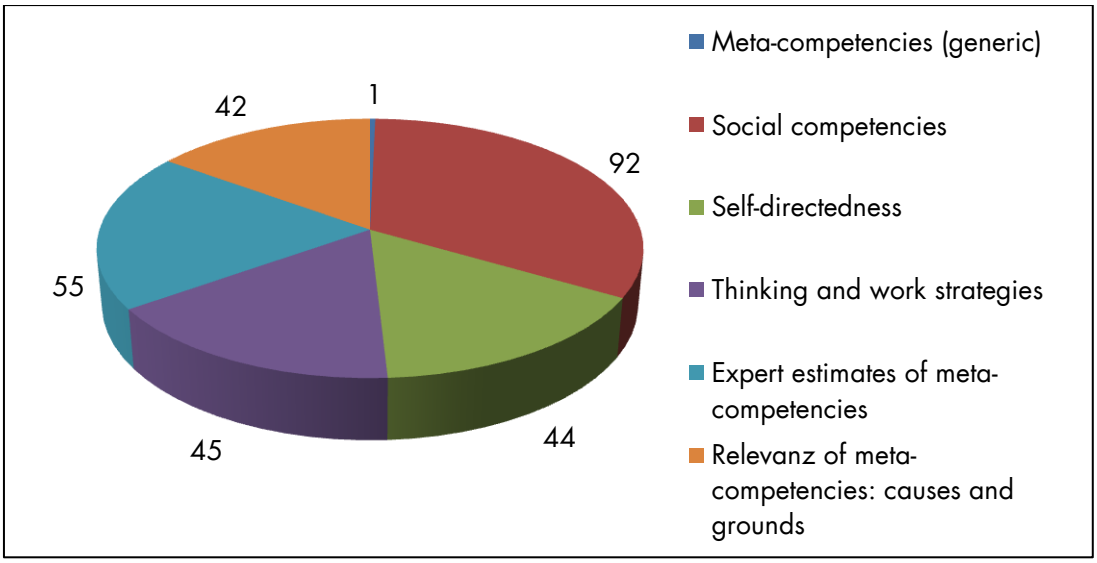
The overall minor differences in the sector- and firm size-specific analysis for ecology and sustainability, including renewable energy, once more suggest the conclusion that a curriculum that spans industries is possible and meaningful.

It is also clear, taking the example of ecology and sustainability, that the energy and water industries will be marked by far-reaching changes in the future, which, if university business graduates are to master them, will require not only specialized knowledge, but above all – in this the experts are unanimous – meta-competencies (soft skills). We address the relevant findings in next.

3.2.4 Findings for meta-competencies (soft skills)

A total of 25 experts addressed meta-competencies (soft skills) in approximately 280 statements. Figure 20 shows how the distribution of the expert statement content.

Figure 20: Distribution of statement content



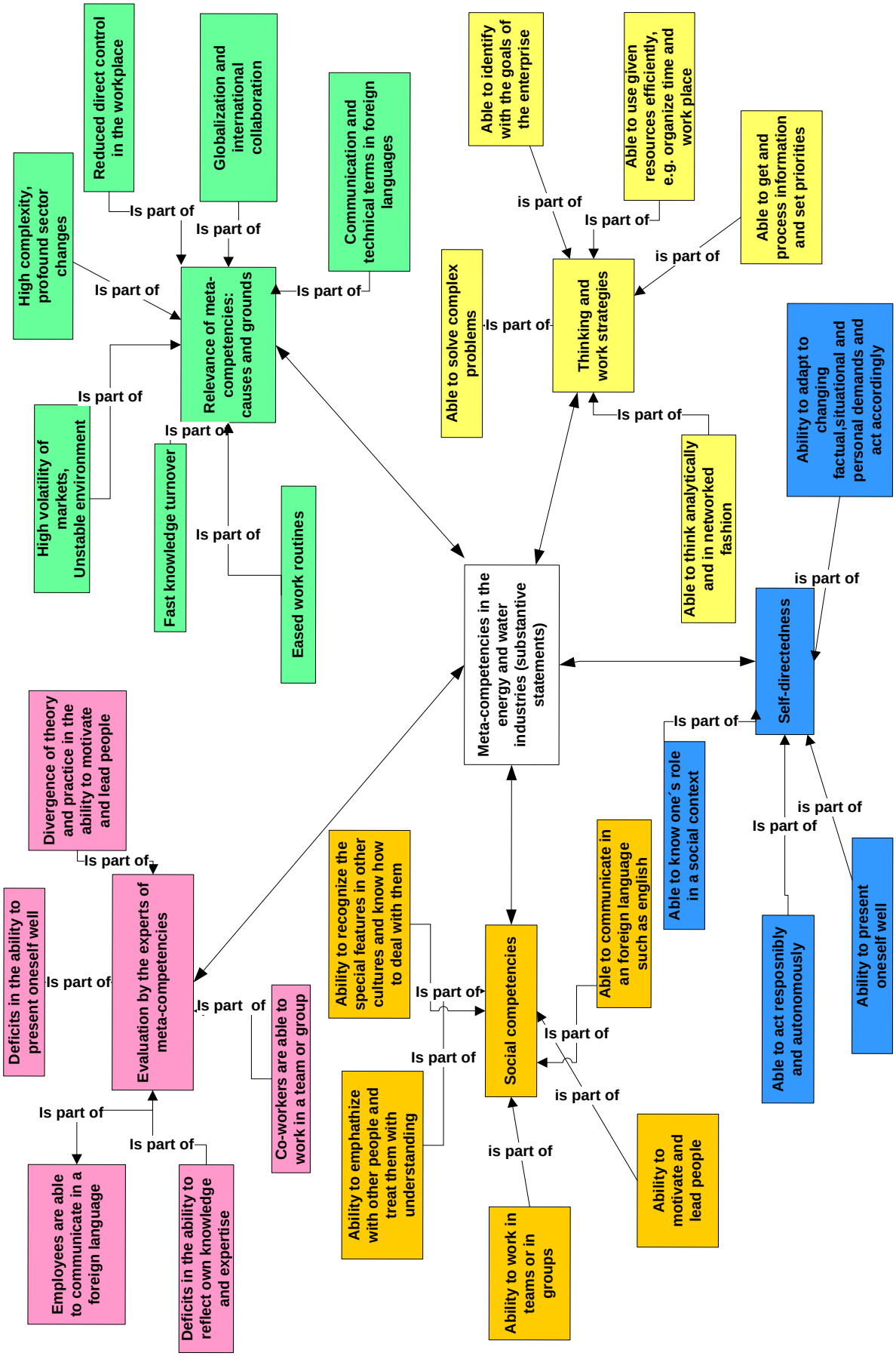
The data layout permits the conclusion that the experts perceive the highest value in social competencies. A total of 92 statements were coded for this. With regard to self-directedness, 44 statements by a total of 20 experts, and with regard to thinking and working strategies, 45 statements by a total of 13 experts were coded. Beyond that, 20 experts expressed themselves in a total of 55, in part highly differentiated, state-

ments about the university graduates having or lacking meta-competencies. 20 experts addressed the relevance of meta-competencies in 43 statements.

Figure 21 illustrates the results of content analysis for meta-competencies.

The network diagram areas highlighted in color assemble aspects that play a special role as viewed by companies in the energy and water industries. On the one hand are descriptions of relevant social skills (orange), self-directedness skills (blue) as well as thinking and working strategies (yellow); on the other hand, the experts cite concrete causes or grounds for the (increasing) relevance of meta-competencies (green). They further gauge to what extent these competencies are found in contemporary university graduates and co-workers or what the deficits are, and they assess the need for education and continued training in this area (violet). Because of the limited amount of space, only the most interesting expert statements were selected for the graphic display. In this respect figure 21 represents an extract of all statements.

Figure 21: Meta-competencies in the energy and water industries



We detect a total of six structural patterns (see Table 4)

Table 4: Structural answer patterns for meta-competencies

Number	**Short description**
Answer pattern 1	Requirements – relevance – grounds – assessments – other
Answer pattern 2	Requirements – relevance – grounds – assessments
Answer pattern 3	Requirements – relevance – assessments – other
Answer pattern 4	Requirements – relevance – grounds
Answer pattern 5	Requirements – relevance – assessments
Answer pattern 6	Requirements – relevance

Table 4 shows that the expert statements reflect specific argument chains that must be given consideration in designing a university-level course offering. They are explained using answer pattern 1 as an example:

Answer pattern 1 (Requirements – relevance – grounds – assessments – other) describes the most inclusive argumentation chain. It contains statements about which requirements exist for individual meta-competencies, to what degree and why these competencies are relevant, to what extent contemporary university graduates possess these competencies, or what deficits exist; and what other aspects (e.g., ones related to designing a university education) require attention.

- On the one hand, the experts rate being able to communicate and negotiate in a foreign language, e.g. English, as very important (19 statements). They explain the relevance by saying that English is the technical and contract language in Europe, that negotiations with business partners are in the English language or new technologies are documented in English. The experts underline that, although contemporary university graduates in general possess an adequate language level, there are some deficits (e.g., when it comes to fluency in

negotiations). They stress that the requirements vary according to company, work location or region and functional area.

- On the other, the experts rate being able to work as part of a team or group (12 statements) as very important. This is above all justified by the increasing prevalence of project teams or changes in the way companies are organizing. Although the experts confirm that the university graduates are capable of team work, they nevertheless see the need for a high level of education and training in collaboratively project work design. Competence in working on internationally-constituted teams particularly can only in part be learned on the job, requiring instead specific, teaching support (e.g. with practical exercises) as part of an institutionalized learning-to-learn process.

As part of our analysis, we investigated to what extent the expert statements exhibit special features or differences and commonalities.

Overall, it can be said that the gas, water/waste water and electricity sectors differ with respect to the subject area "meta-competencies" only in very few aspects of the content; to be exact, in fewer than ten percent of the network categories. The differences consist primarily of perceived competencies or deficiencies as possessed by university graduates in individual companies.

- The surveyed experts in the gas sector put particular stress on the university graduates knowing how to communicate or negotiate in a foreign language.
- The experts from the electric power sector stress especially that there is a pronounced need for education and training in competencies that allow co-workers to work on projects.
- The experts surveyed in the water/waste water sector give prominence to deficiencies especially in university graduates' leadership skills.

Similarly, the statements concerning meta-competencies exhibit few differences related to company size.

- The surveyed experts in small firms underline especially that while the university graduates have a great deal of self-confidence, they do not know how to present themselves well.
- The experts in medium size companies detect deficiencies especially in the ability to reflect personal knowledge and expertise.
- Experts in large enterprises stress the need to be empathetic and understanding of others, to fit in the social environment and to act responsibly and with self-assurance.
- In addition, experts in large enterprises also signal that it is important to communicate and negotiate in a foreign language when participating in international teams. There is a pronounced need for education that aims to develop skills for project work. They see deficiencies in university graduates particularly when it comes to solving complex problems, questioning structures and processes critically and in adopting the enterprise's goals as their own.

Comparison of the expert statements regarding meta-competencies with the results of the written survey shows a close congruence. Thus, both studies emphasize that university business graduates especially in the energy and water industries:

- should possess high social competence and be able to work in teams,
- should master modern information and communications technologies,
- must possess strong communications and persuasive skills.

In addition, there are numerous other meta-competencies regarded by the experts as very important that were not addressed in the written survey. For example, these include competencies in

- being assertive, being able to make oneself understood in conversation and being able to resolve conflicts,
- reflecting one's own knowledge and skills and developing them continually,
- adapting to changing demands of a factual, situational and personal nature and to react accordingly,
- thinking analytically and in networking terms,

- being able to solve complex problems.

While leadership ability and intercultural competence are regarded as important in the written survey, in it they are rated as being less relevant than team competence and general communications skills. During the in-depth interviews, the experts judge these two latter facets to be especially important and state further that there is a pronounced need for education and training in competencies that will let university graduates do effective project work. In the written survey, depending on their size and sector, the companies rate very good and technical English skills as less important to important. The experts interviewed, however, regard foreign language competence consistently as extremely important.

Overall, it is clear that, without express competence in soft skills, it is scarcely possible to cope with the growing complexity of work demands. For this reason alone, special didactic-methodological importance must be attached to forming meta-competencies within a framework of university-level studies.

4 Summary and Outlook

The findings presented are only an extract from the extensive data material; nevertheless, they suffice to show that the knowledge and skills expected by industry from business specialists and managers diverge significantly from previous, traditional requirements models. They show that the requirements have become more complex, in both their spread (connections between different specialty fields) as well as their depth (scope of knowledge and specialty knowledge), and that motivation, engagement, self-direction and other meta-competencies have attained a special importance that seems to be continually growing.

Although the data certainly demonstrates that all those surveyed emphatically call for changes in how specialists and managers are educated and trained, as yet they have developed few systematic ideas concerning them at this point. This is problematic both with respect to the time horizon for designing and implementing study programs as well as for the background analysis of existing course offerings. At this time, there are

no study programs that fully live up to the demands raised by industry (see also "Analyse kaufmännischer Studienangebote für die Energie- und Wasserwirtschaft an Universitäten in Deutschland," March 2011), and setting up or revamping course offerings in the bachelors and masters structure requires considerable lead time. This gives the issues of developing an appropriate university-level curriculum and the subsequent rapid deployment of suitable course offerings particular urgency.

In the first place, this calls for expert workshops in which university professors together with practitioners can define and develop the objectives and contents as well as organizational forms for teaching and study processes. The data presented here can provide a solid, empirically sound foundation for this.

We will address the progress and results of this workshop in future publications.

Project-related publications:

Fit für die Energie- und Wasserwirtschaft: Wissen und Können von kaufmännischen Fach- und Führungskräften – *Eine repräsentative Unternehmensbefragung*
(ISBN 978-3-9815184-0-5)

Fit für die Energie- und Wasserwirtschaft: Wissen und Können von kaufmännischen Fach- und Führungskräften – *Top-Manager im Interview*
(ISBN 978-3-9815184-1-2)

Fit für die Energie- und Wasserwirtschaft: Wissen und Können von kaufmännischen Fach- und Führungskräften – *Die Sicht von Hochschulabsolventen*
(ISBN 978-3-9815184-2-9)

Fit für die Energie- und Wasserwirtschaft: Wissen und Können von kaufmännischen Fach- und Führungskräften – *Zusammenschau der Ergebnisse*
(ISBN 978-3-9815184-3-6)

Ready for the Energy and Water Industries: Knowledge and Skills of Business Professionals and Executives – *Synopsis of the Results*
(ISBN 978-3-9815184-4-3)

Analyse kaufmännischer Studienangebote für die Energie- und Wasserwirtschaft an Universitäten in Deutschland
(Forschungsbericht, Universität Leipzig, Institut für Wirtschaftspädagogik)