

## Using a mixed international comparable methodological approach in a European Commission project on gender and engineering

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Veröffentlichungsversion / Published Version

Sammelwerksbeitrag / collection article

**Zur Verfügung gestellt in Kooperation mit / provided in cooperation with:**

GESIS - Leibniz-Institut für Sozialwissenschaften

### Empfohlene Zitierung / Suggested Citation:

Sagebiel, F. (2005). Using a mixed international comparable methodological approach in a European Commission project on gender and engineering. In J. H. P. Hoffmeyer-Zlotnik, & J. Harkness (Eds.), *Methodological aspects in cross-national research* (pp. 47-64). Mannheim: GESIS-ZUMA. <https://nbn-resolving.org/urn:nbn:de:0168-ssoar-49146-2>

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# USING A MIXED INTERNATIONAL COMPARABLE METHODOLOGICAL APPROACH IN A EUROPEAN COMMISSION PROJECT ON GENDER AND ENGINEERING

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## 1 Introduction

The paper will focus on the European Project WomEng<sup>1</sup> „Creating Cultures of Success for Women Engineers“ ([www.womeng.net](http://www.womeng.net)). The project started on November 2002 and will last until end of October 2005. Participant members are universities and non profit women’s engineering associations from seven countries (UK, France, Germany, Austria, Finland, Greece and Slovakia). In four so called work packages (wp) WomEng combines a strong quantitative with a complex qualitative methodology. There are two project parts: education and profession of engineering. In the first part (now completed) questions of choice of degree courses (work package 2) are connected with questions about experiences, satisfaction and dissatisfaction of students (work package 3) and questions of organisational cultures of degree courses (work package 4). A special work package focuses on methodology<sup>2</sup>; others on dissemination and coordination.

The article will demonstrate international and multi methodological comparisons on the issues of gender in engineering education as well as difficulties and possibilities of management of such a complex investigation. The first focus will be on work package 4 (wp4) because of restricted space and because it has been under the German responsibility.

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\* I want to thank Dipl. Soc. Wiss. Jennifer Dahmen for revision and giving helpful feedback to the article. For translation help I thank student Jenia Bouxman, for formal adaption student Shirin Reinhard.

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- 2 Coordinated by Anne-Sophie Genin (France) and Oto Hudec (Slovakia).

## **2 Research Questions and Methodology**

The question of choice of methodology in empirical research has been always depending on research questions and hypotheses. Research questions in WomEng had been structured in 3 work packages mentioned. The hypotheses for analysis of women students, adapted to organisational culture of engineering degree courses, were taken from state of art of European and non European research. The operational definitions of research issues were done in connection with state of the art using different quantitative and qualitative methodological measures.

### **2.1 Hypotheses**

Out of state of the art it was clear that a masculine organisational culture can not be explained by a single aspect but by a complex setting of different cultural characteristics of engineering education. Recruitment measures and welcome events seem to be the first step to offer a changed image of engineering degree courses.

Second interdisciplinary curricula combining engineering with some non engineering subjects together with people oriented teaching methods (e.g. team and group work) should attract more female students. By this measure female students should be more attracted and feel more comfortable while studying.

From North America the single sex learning environment was one alternative cultural setting to prove. As in the European partner countries possibilities for single sex studying in higher education do not exist at the moment, this hypothesis could only be proved in Germany where some single sex model projects exist in a few universities of applied sciences.

The minority situation of female students in engineering was one focus to look at and ask if it was evaluated negatively or positively, and if females would possibly meet hostile attitudes from their male colleagues and/or from teachers. From Australian research one hypothesis was taken, looking at faculty in departments of engineering education as possible and necessary change agents for innovations.

Another hypothesis was that the enduring masculine image of engineering in society is reflected in departments of engineering degree courses and this could be a barrier to female students. The possible conflict between identity as women and identity as engineering student, taken out of literature, should be proved about its effects.

The study atmosphere is constructed by environment and social relations. And even more, masculine jokes and stories characterise the study culture. These characteristics may lead to feelings of isolation because of minority status and female students could experience marginalisation. On the other hand a controversial hypothesis was that young female students would feel comfortable in engineering degree courses and integrated in organisational culture.

## **2.2 Definition of work package and selection of methods (Berting, 1979)**

Basis for development of methods was the overall methodology, prepared in proposal and discussed and decided in project meetings. In the beginning of the project the leader of work packages and the different teams preferred specific quantitative or qualitative methods on the basis of proposal and the tasks formulated there. Starting at first with the quantitative questionnaires for engineering students out of wp2 perspective this instrument was enlarged to work package 3 and 4 issues to avoid several similar investigations with different samples of questions. But, by this way the questionnaires got larger and after all took nearly one hour to fill.

On the other hand qualitative instruments were preferred from leaders from wp3 as well as from wp4, work packages with tasks which had been formulated to get more complex information and a deeper understanding of interdependences. While discussing and changing of methods these instruments were used also for understanding the underlying reasons for choice or non-choice of engineering degree courses (wp2) and attitudes for drop out or persistence (wp3).

To get known the institutional possibilities and barriers for an innovative women friendly engineering culture, the proposal for wp4 planned besides quantitative questionnaires for students three types of qualitative methods: expert interviews, participant observation and document analysis (homepage analysis).

So for example for the task to gather information about the culture of engineering departments most of the qualitative methods have been constructed and data have been collected. To get different perspectives engineering students and faculty of departments and universities were asked. Faculty interviews with representatives for degree courses, expert interviews with members of steering committee and officials from equal opportunity office have been done. The perspective/view of students came in from individual interviews with persistent and non-persistent students and especially from focus groups with female and male students. Focus group discussions have been experienced being a helpful method in all partner countries, which made focus groups with students (Austria, France, Germany, UK).

In summary, the description, analysis and interpretation of culture of engineering departments is based on non-reactive methods like homepage-analysis and participant observation as well as on more subjective methods of expert interviews and focus groups, which reflect students and faculties point of views and attitudes. As a non reactive method 35 homepage analyses of the investigated institutions and degree courses from 6 partner countries – Slovakia did not have to do this method – have been done. Participant obser-

vation has been done in 4 partner countries (Austria, France, Germany, UK). The filled criteria catalogues had been analysed by one student from the German team, who wrote his diploma thesis about this issue.

For the task to determine the impact of innovative engineering courses as part of wp4 the same instruments like those selected for description of organisational culture were used.

### **3 Quantitative Methodologies – The Survey**

The quantitative methods have been mostly restricted to the first part of the project. Most of the time has been concentrated on construction of written questionnaires. For the design of the guidelines validity, reliability and sampling methods had to be taken into account.

100 female and male engineering students (with questionnaire 1 – Q1) in each country were compared with a group of 100 non-engineering students (science, social science and humanities, economics) (with questionnaire 2 – Q2). In each country characteristic institutions of higher education were chosen for investigation.

#### **3.1 Construction of questionnaires (Porst, 1998)**

In WomEng several drafts of questionnaires have been made. At first the wp2 leaders prepared a draft of questionnaires. This method was intended to serve for getting data about choice of degree courses and steps to decision. Full of questions about heritage and connection of ancestors to engineering professions, it focused on reasons for decisions or non- for an engineering degree course. This draft was discussed partly very controversial on the first project meeting. After this meeting it took some time with misunderstandings on what was agreed and what issues should be included in the questionnaires. Because of coordination problems some partners who had not participated so much in this discussion, started investigation without the final version. On the basis of pre-tests, hypotheses and ideas to be included the questionnaires were changed several times. The language, in which discussion took place, was mostly English. Only between Austria and Germany German communication was possible and was practiced. Except the meetings discussions were made by emails. After all, contents and questions of all work packages were integrated in the questionnaires.

The final version was worked out in English language by a native speaker and a partner from Scotland, UK. These final drafts of Q1 and Q2 had to be translated again in national languages to be given to the students for filling. The translations were organized and done by national teams, but usually not controlled by language specialists.

After all, the questionnaires had to be prepared in a form to allow easy statistical analysis. For this task the Slovakian statistician controlled the questionnaires. Several possibilities in accordance to time and money were discussed even the possibility to take a private company as subcontractor for statistical preparation of data, but this idea was given up.

### 3.2 Sampling methods and practice per country

Two *standardised questionnaires* for engineering students in comparison to non-engineering students were prepared and were offered to 50 female and 50 male students as a control group in all 7 European partner countries. Sampling of degree courses was oriented on the basis of lower, middle and higher percentage of female students depending on national statistics, choosing the most from degree courses with the lowest number.

For reliability of the samples in different countries three comparable groups in different percentages should be taken from degree courses, referring to the number of women in them. For example, mechanical engineering or computer science should be taken for a very low percentage of women, surely depending on the national situation of partners. As example for high percentage of women bio-something or civil engineering (without architecture) were possible. Third to the samples of worst and best situation according to the percentage of female students there should be taken also an example with an average percentage of women. Because of national variations not in all countries the same degree courses were chosen. This sampling allowed internal control of engineering degree courses, if there were differences in choice, satisfaction and studying atmosphere. On the other hand it gave a basis for generalisation of results.

In the non-engineering control group 100 students (50 female and 50 male) should be chosen, 40% students in natural sciences, 20 % in social and human sciences and 40 % in economics.

In each country characteristic institutions of higher education should be chosen for investigation. The number and characteristics of chosen institutions should include their history, tradition, localisation and culture of higher engineering education. In Germany, for instance, aspects of federal system in higher education were included.

In Germany for the selection of good practice in engineering degree courses the opportunity to investigate a single sex model of industrial engineering degree course was taken. This example offered the possibility to learn how an organisational culture could be changed by an innovative degree course. Because in the other partner countries no such changes initiated by any innovative engineering degree courses have been described, there is no systematic international comparison possible.

### 3.3 Validity and reliability measures

In literature about adequate methodology for international cross-cultural and interdisciplinary research several equivalence problems are discussed (Simmet-Blomberg, 1998: 292-344), which had to be solved. First of all the term “engineer” had to be clarified. It was agreed upon that all students/persons with an engineer degree should be taken for comparison, even though we knew that different systems of secondary and higher education in different countries as France, UK and Germany lead to different professional competencies and positions.

For getting valid answers for issues of wp3 (satisfaction) and wp4 (organisational culture) students should have been advanced enough in their studies to be able to appreciate these questions. Similar sampling criteria had been formulated for non-engineering students.

Several equivalence problems had to be taken in account:

(1) Content equivalence, which means functional, conception and categorical equivalence: e.g. women’s situation in EU partner countries which has been one background for the project, was appreciated to be equivalent in western European countries, but in comparison to Slovakia different. As a result of 45 years of communist political, social and cultural system there was expected a quite different gendered labour division in the professional sphere. So in Slovakia more women in engineering and science were expected in comparison to western European countries, while at the same time in the private sphere traditional labour division was still expected.

(2) Different cultural sensibilities to research measurement should be coped by communication between EU partners.

(3) Language and translation problems had to be solved.

(4) In respect to sampling methods there exists a conflict between casual and controlled sampling. While the first serves reliability the second allows intercultural comparison. In WomEng controlled sampling methods had been chosen.

(5) Equivalence of definition: Even if the chosen degrees and degree courses in European partner countries were not the same, there were different criteria for control (see above).

For *reliability* of results from quantitative questionnaires control groups are most important. In WomEng male engineering students as well as female and male non-engineering students should be taken in account according to the key moments for female students to decide to become engineers or not, go on with studies or drop out. Sampling of non-engineering control group had to take in account different national structural and institu-

tional possibilities for choosing a degree course. So for example in UK and France students have to decide at a very early stage of life depending on their exams in maths and physics and this pre-decides, what is open for them. In France the success in preparatory classes decides who can become an engineer – only the best ones can. On the contrary in Germany students are free to study anything after finishing with mature.

Even though *pre-tests* (Porst, 1979) should be made in national languages to control general understanding of the questions, not all national teams made these pre-tests. In countries which worked with pre-tests of the questionnaires problems of understanding were sent to coordination of questionnaires for revision.

### 3.4 Implementation of survey

The quantitative and qualitative sampling has been carried out based on the second overall methodology of the project. The first calculations and thoughts for the sample were made on the base of 200 distributed questionnaires per target group. With this more diversification would have been possible, which afterwards had to be skipped because of less total numbers.

An overall criterion for choosing or not choosing a university was that the considered institutions must offer special activities to recruit and inform girls. The speciality of Germany, which offers single-sex degree courses in engineering degree courses, was from high interest too. The University of Applied Sciences in Stralsund with the women's degree course Industrial Engineering was chosen as example for good practice.

The implementation strategy varied from country to country even though there were the same guidelines for all. Some countries mailed the questionnaires to institutions to be spread by some persons while others travelled to the selected institutions and spread the questionnaires by project team personal who often watched the filling of questionnaires being able to answer questions if there were any. Whereas in France and Germany most of the Q1 questionnaires were handed personally or with close connections to faculty teaching in engineering degree courses, in other countries like Greece and Austria the questionnaires were mailed partly with problems of getting back the responses in necessary numbers. The non-academic Greek and Finish teams had more problems to get contact to reference persons in universities. For the French team, working in engineering schools themselves it was harder to reach non-engineering students, for Germany it was likewise easy to spread Q1 and Q2 and get them back. Because the guidelines have been implemented differently, one cannot decide what difficulties in getting filled questionnaires were due to country specialities and what due to different handling.



Interesting is that in Germany, where many problems had been expected before starting because of the very liberal higher education system, the team did not meet any serious problems getting enough questionnaires back and sticking to the guidelines. The most prominent reason was probably the very thorough preparation in management from reference persons in every degree course. For students, who took part in the survey, small presents like pencil and chocolate were spread. The implementation of investigation was concentrated on 2-3 months.

Problems were mentioned, that questionnaires were very long, some items were misunderstood, not adapted to the question. Others were not adapted to the national context, e.g. women special recruitment programs do not exist in France. Another problem was the French idea to force engineering students to return Q1, while this practice was a way, which never would have been possible in the German system. So, as the French team sees volunteering as a source of bias, in Germany you only could rely on volunteer students.

For analysis questionnaires results were entered manual in most cases with the help of a specific soft ware.

A problem was that while prolonged time for construction of questionnaires semesters for students to be asked had finished in several partner countries, and so the time for starting the survey was later than first planned.

## **4 Qualitative Methodologies – Completion of Survey Data**

The quantitative questionnaires were combined with a number of different qualitative methods from which the researchers hoped to get a deeper insight in interdependencies. Each of the following methods should not be seen detached from the other ones and has its own possibilities. To prove validity and reliability of the results, they can be compared among each other and also work in a supplementary way, e.g. the results of the quantitative interviews can be checked by focus group discussions.

For the qualitative part of the investigation the methodology of the wp3 and 4 were the base. Most of the qualitative methodologies were used for wp4 and constructed by the German team in cooperation with other partner countries. The results have been the base for reports for dissemination, which sum up organisational cultures and innovative structures of degree courses with a low percentage of women (Sagebiel & Dahmen, 2005).

### **4.1 Guidelines and sampling for qualitative methods**

Students were qualitatively interviewed as individuals and in focus groups to see how much their individual experiences correspondent with each other. Focus groups should allow to prove if group dynamics can further the perception of and talking about gender

discriminating aspects of study life, to exchange attitudes of the image of engineering, and how to overcome eventually masculinities of education in engineering. Website analysis of women friendly and women aversive measures in advertising engineering degree courses was done to describe and compare the culture at first glance. Male and female faculty were interviewed with semi-structured expert interviews about the practice of their institution/department in advertising, teaching, advising, mentoring, working atmosphere, eventual marginalization or friendships, image of engineering, attitudes towards single sex education in engineering etc. Members of steering committees and equal opportunity officers were asked about political decisions in engineering education, for example the drop-out-situation and measures of change. Non-participant observations of departments and teaching situations allowed a different perspective on the engineering culture.

All qualitative methods should be done in the same institutions, universities and departments as chosen for Q1.

### **Interview guidelines**

For all interviews a similar method was used as a guideline, combining open with partly closed questions, completed with estimations along with Likert scale.

#### *Students interviews*

For complementary of quantitative questionnaires there were about 10 *guided interviews with female students* about their choice of degree course, experiences and satisfaction with study life, content, teaching methods and atmosphere and knowledge about reasons for drop out (most of all work package 3 issues). For work package 4 relevant issues were experiences and attitudes they met during studying. For comparison with questionnaires results a similar sampling was chosen, taking 3 students from degree course with a very low percentage of women and 2 from a degree course with a high percentage of women. The five female students, who had dropped out, should be taken from a degree course with a very low percentage.

#### *Faculty interviews*

Faculty as representatives for degree courses but not responsible persons – this choice was made to avoid social desirable answers – could give information out of teacher's perspective and they could be asked about their attitudes and estimation of female students, the department culture and possible barriers (prejudices). So faculties were asked about their ideas to make engineering degree courses more attractive as well as what they still practiced on self-advertising. Teaching methods, system and organisation of advice and men-

toring and practical experiences with gender differences were of interest, especially what teaching methods they favour and what they think female students would prefer. Description of working atmosphere with Likert scale from competitive, supportive, hierarchic, communicative to traditional was asked and if they believe it will be more supportive for men or for women. The same was asked for the students' working atmosphere. Social network and students' integration in faculty's meetings was a further issue. Special problems of female students in a degree course with a low number of women were asked and if they heard about those problems in mentoring and advising hours. Faculty in degree courses with a high percentage of females should give hints for a possible good practice and how to change more traditional structures. Attitudes about single sex education were asked to test their acceptance of changing possibilities. Treatment of females, possible mobbing and knowledge about dropping out and special reasons of female students were interview parts, especially for measuring dissatisfactions (work package 3). How they estimate the image of engineering in society and if this image is reflected in the culture of department was an issue for work package 4. The semi-structured questionnaire for expert interviews was similar to the faculty.

All interviews should be taped and transcribed afterwards. They should be analysed and interpreted first on the national level and put in summaries and sent to work package leader to be included in cross-cultural comparative reports.

### **Guideline for focus discussion groups**

Looking at state of the art, it seemed not to be an easy job to get information on gender sensitive issues in the engineering field, where the main culture is characterized by perfectionism, seeing weaknesses and problems as not social desirable. In a group situation it seemed more probable to get beneath the superficial level. When discussing the methodological design on international conferences and presenting the feared problems to get valid information on gender issues in engineering degree courses, women scientists proposed focus or discussion group as a method to get hidden opinions and attitudes, which are more difficult to get in individual interview.

The aim of *focus discussion groups* is generally to get closer to the understandings and views of participants on certain issues. Special attention had to be paid to the use of focus groups together with surveys: the focus groups could be used for testing results of the surveys or could provide the issues which will be tested with the questionnaires. Focus discussion group is an important method because in the focus groups you talk to several people at the same time and participants talk to each other and can compare their experiences and attitudes. Maybe it came out that two people see the same thing in different

ways. These differences are very interesting because they could provide information which had not been thought of before.

After discussion of several possibilities to have different guidelines for female and male groups it has been decided on basis of time and money to have one guideline with special questions for women and men differently to allow comparison of attitudes of female and male students. Both groups should be close to the final exams to be more aware of gender differences in comparison to first semester students. Sampling should be made from a degree course with a low number of female students. The male focus group should be taken from an equal degree course to allow comparison.

There have been two parts, one biographical sheet, especially for wp2 with data about relatives and their influence besides some other demographic data (secondary education, sex, age, nationality) and objective study information. The second part contains questions about issues on study background, quality of social network in connection with study life, study atmosphere, how it feels, image of engineering, if it corresponds to department culture. Last but not least there were special questions for females and males. Female students were asked about how they were treated in comparison to male students, about their possible role models, their opinion about the women's recruitment programs and if they would prefer to have more women in their degree course. Male students were asked about opinions about female students in their degree course and how they appreciate girls' recruitment programs, if they think that females feel alone sometimes and if they as male students would prefer to have more females in the course and if they think women are treated equally to men.

Size of the groups should be about 5 participants. The discussion should last up to 2 hours and be videotaped.

### **Guideline for observation**

For wp4 open *participant observation* (Warwick, 1973) was chosen because with this method it was possible to evaluate the study environment as well as people acting and reacting in everyday situation. At the same time this method could control eventually social desirability of interviews as reactive methods.

Data from *participant observations* of co-operative structures and teaching styles (frontal lessons, teamwork, projects) in studying and laboratory situations in traditional engineering faculties and those with innovative degree courses helped to determine the impact of the latter. Lectures of different subjects should be chosen for observation (subjects having a strong image and subjects having a soft image). Observed lectures should be given by

men and by women. Besides visual characteristics of department and gender/diversity special information on boards etc. could be observed by visiting engineering departments. Observation can't be seen as a method which is limited to 'seeing', of course it's also 'hearing', 'feeling', 'talking' and 'reading'. Even though participant observation (overt and covert) is not the most reliable research method, it offers the possibility to study a process in action and it is easier to take note of non-verbal behaviour of the people being observed.

### **Guideline for website analysis**

The *website analysis* as a type of *document analysis* has been used for investigation of different dimensions: text to analyse the written text, graphics to analyse pictures and the colours used, usability to analyse whether all relevant texts are available, whether all sites can be shown easily (no broken links), whether there is the chance of communication to get further information etc. To combine all these dimensions a criteria catalogue has been constructed which had to be filled during surfing on the website. Website analysis should give information on integrated internships, welcome meetings, mentoring-, equal opportunity-, gender mainstreaming-, diversity-programs, life long learning possibilities and re-entry programs.

Even though the importance of this method seemed to be not so high in some countries looking at the number of students who looked at it for information as answering in the quantitative questionnaire, the future development will increase the use of homepages as source for information.

## **4.2 Implementation of guidelines**

### **Sampling**

The German sample consisted of five institutions of higher education, which were chosen to include different types of universities as well as partly regional specialities from Eastern and Western Germany. The sample constructed for questionnaire survey with engineering students (Q1) was taken too for the qualitative methods. The questionnaire for non-engineering students (Q2) was distributed at four the following universities. As one institution for good practice for organisational culture of engineering degree courses a model single sex degree course in industrial engineering installed in the University of Applied Sciences in Stralsund has been chosen. One comparable institution was the Technical University of Applied Sciences in Berlin, in which students as individuals and in focus groups, faculty and experts were asked.

Because of the different school systems and decision processes and entrance criteria for engineering degree courses for France and UK the sampling for questionnaires for control groups has been different in comparison to guidelines and other partner countries. Both had many problems getting Q2 in return. In Slovakia one institution has been chosen for all qualitative interviews and the team point to the aspect that this allowed intra-institutional comparison of students', faculty' and experts' answers. The selection was aimed to obtaining of comprehensive overview at the problem at the same university from selected groups (female successful students, non persistent female students, faculty staff member and steering committee member). A similar sampling was taken in Austria. Sampling has been implemented differently, taking one institution (like Austria and Slovakia) or different universities (like Germany and France).

### **Field work**

To find five engineering students for two focus groups (male and female ones separately) out of degree courses with a small number of female students was not so easy, especially female focus groups were not easily to build, when there was only one women in each semester or deepening course. Austria used a snowball system to get enough students for focus group. This strategy did not work effectively in Germany, where the selected universities were situated in long distance to the home university and several research methods had to be finished in a few days.

Participant observation was clear and easy to follow the indications. While in France it was not so easy to find a teacher volunteer who allowed his or her lecture to be observed, in Germany for example there have not been any problems to get allowance. The timing for observation was important, especially to be not too late in the semester.

Website analysis made no big problems, but asking about the feeling of an atmosphere from a photo and working with alternatives like "warm" and "supportive" seemed for some teams too subjective. Another point was to recognize a gender discriminatory language. In German it is easy, when only the masculine form is used as a norm. In English one can only recognize discriminatory elements, if in gender unspecific cases the reflexive pronouns are used in masculine form only: he, his, him etc.

### **4.3 Analysis of qualitative data**

For wp4 the input from partner countries was collected depending on the methods taken to get results in two steps. The first step was to gather raw material from all partners (we got less from Greece and Finland) on base of summaries along guidelines which had been prepared by work package 4 coordination and discussed and changed on work package leader meetings and per email.

For wp4 deliverables a common structure has been prepared by German team. This structure was discussed and changed by partners on a work package leader meeting. For helping to fill the structure a table with all empirical methods together with the number of questions and items to be integrated in the structure had been prepared and spread. The German team asked for two national summaries along with the necessary two reports for dissemination. At the same time a common structure was given, and for operational definition a table, which included all questions from different methods – quantitative and qualitative –, detailed structured for the final reports. This table constructed to help to fulfil the task nevertheless disturbed some partners who were not accustomed to work with tables in their professional life. It worked only after there had been given a practical example of national reports together with the detailed structure.

## **5 Problems of Cross-Cultural Comparison (Harkness, 1998; Simmet-Blomberg, 1998)**

In summary our experience with quantitative and qualitative methods in a gender focused European research project on engineering shows three levels of problems of cross-cultural comparison:

### *1<sup>st</sup> Problem of comparison of different cultures*

Having experience in cooperation out of the former European Commission Project INDECS ([www.INDECS.uni-wuppertal.de](http://www.INDECS.uni-wuppertal.de)) the RTD-research project WomEng was not so overloaded with intercultural misunderstandings.

Some questions were depending on country specificities and did not make sense in all countries. For example in French engineering schools women's welcome days or girls recruitment programs are not known. So these questions were inappropriate in France.

There were some questions which were not politically correct in one country, but these questions differed from one country to another. So diversity questions are not politically correct in France and UK whereas questions about income are not politically correct in Germany for instance.

Looking back to the difficulties in international cooperation one prominent point was the different working styles depending on disciplines in combination with nationality. In research there is a necessity to overcome the separated worlds by communication and to find common definitions and solutions how to investigate the issues adequately in all participating countries. Implicitly too was how the politically engaged research was legitimized in comparison to so called scientific distance.

Disparate secondary and tertiary educational systems together with the problem to compare particular societies which are mostly non-comparable, are the backgrounds from which young females decide their studies. These decisions are made with different perspectives for study and professional life. Nevertheless if you speak of Europe and this should be meaningful you have to make compromises and try to construct comparability to overcome particular perspectives.

But the first problem was that the different disciplinary and cultural backgrounds of the scientific workers led to very different preparations of the empirical work. The sampling concept besides of the different numbers for degree courses with high and low percentage of women students was practiced very differently from one country to another. In Germany for example there was a trial to get data from different regions and represent a bit the federal system of education. Also different types of higher education institutions for engineering education were taken into account: technical universities, universities for applied sciences and comprehensive universities.

There were some translation problems<sup>3</sup> and partly the final guideline, which was used, was not exactly the same. For example some translations from English to German did not meet the same connotation and made comparison problematic after all.

### *2<sup>nd</sup> Methodological problems*

Methodological problems are partly at the same time due to cultural differences. Another important point was the underestimation of time to be needed for statistical analysis of questionnaires which was finished short time before final deadline for project reports.

If cross-cultural comparison should be done in time one need data from all countries to a special date to put them together for systematic analysis and reports. At first the project partner agreed upon the guidelines for quantitative questionnaires. So, one could expect to get cross-cultural comparable data more or less if one neglect translation problems from common English questionnaires to the national languages of partners.

But one problem was not taken into account, which seemed crucial after all: the schedules seemed to be of different obligation depending on national characteristics, type of the partner organisation etc. It has been an important experience that a clear and definitely formulated letter to all partner teams to get all reliable and valid information for international comparison did not lead to success every time. So the definition of deadlines was not the same in partner countries, partly along with the different roles in research. Delays

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3 Complexity of those translation problems are described in Harkness, van de Vijver & Johnson, 2003.



of country specific raw data and summaries and delay of statistical analyses culminated so that for example reports on organisational culture in large parts have not been comparative analyses, especially not on quantitative results of the questionnaires with students. And for this empirical part so much preparatory work had been done.

Some tables integrated in guidelines for interviews disappeared from one country to another, and these questions were not answered therefore and could not be compared afterwards.

The implementation of qualitative interview guidelines were differently too. While some teams took the guideline as definitely others took it only to ensure that none of the important topics were left out.

So after all not all data were produced in every country, partly because of the lack of money, but mostly out of other reasons. The outcome for the quantitative part of the project was besides others that too small numbers in cells for special items existed which did not allow special statistical measures and tests.

### *3<sup>rd</sup> Problems in connection with gender research*

International construction of a quantitative questionnaire is full of adventures, especially in a European project on gender issues, working together with a mixed sex partner team out of different disciplines as well as traditions/non-traditions of feminist thinking. Out of perspective from a women's studies researcher it has been somewhat strange to implement a women's studies project in a team of mostly non-feminist researchers – women and men. This meant that they were not at all familiar with thirty years enduring discussions of gender issues and theory. The implicit question was if gender is a category as others or if it is a social construction in different European countries, defined by gendered division of labour.

In methodological language the different situation of women in partner countries could be seen as equivalence problems of different gendered labour division in European societies (see 3.3).

During discussion of questionnaires several times questions were skipped because they openly transferred gender prejudices and argued that this was not political correct, asking those questions in another country like Germany.

One very different aspect of department culture in France versus Germany and Austria in connection with gender was special recruitment measures for female students. Whereas in Germany and Austria it is a question of quality of departments and degree courses, and the

German and Austrian team took these measures as criteria for good practice institutions, in France students and faculty did not know anything about these, and when the interviewees understood what meant, they answered this differentiation by sex should not be and would not be political correct.

In respect to single sex education cross-cultural comparison is not possible because in partner countries those models do not exist.

One inherent problem getting true answers in interviews and focus groups has to do with social desirability. Especially about discriminating characteristics there is a tendency to get unbiased answers. For example “willingness of verbal account” with jokes and stories as team characteristic – often told about in literature – perhaps was not openly talked about, because it is not political correct in most European countries at the moment.

## 6 Conclusions

To further international comparable methodological approach it is necessary to communicate possible cultural differences and prejudices to overcome them. Methods should be developed in communication with all scientists working together in the project, and in this doing formal commitments and informal communication channels should be used, even by emails. All persons engaged should be flexible and sensible enough to recognize strength and weaknesses of partners to compensate, when it is necessary to do successful serious research. These elements come together with more methodological characteristics of comparable research, like cultural diversity and problems of terms, vocabulary, translation, inconsistencies, of measurement differences (Harkness, 2005 on an International Methodological Workshop in Kosiçe, Slovakia).

## References

- Beraud, A., and J. Soubrier. 2003. „Are Women the Future of Engineering? WOMENG – A European Research on Women and Engineering Education.” Pp. 312-318 in *Sefi Conference – Global Engineer: Education and Training for Mobility*.
- Berting, J. 1979. “A Framework for the Discussion of Theoretical and Methodological Problems in the Field of International Comparative Research in the Social Sciences.” Pp. 137-156 in *Problems in International Comparative Research in the Social Sciences*, edited by Berting, J., and F. Greyer. Oxford, New York: Jurkovich, Ray.
- Connell, R. W. 1999. *Der gemachte Mann: Konstruktion und Krise von Männlichkeiten*. Opladen: Leske und Budrich.
- Etzkowitz, H. et al. 2000. *Athena Unbound. The Advancement of Women in Science and Technology*. Cambridge: Cambridge University Press.

- Faulkner, W. 2000. "The Power and the Pleasure: How does Gender 'stick' to Engineers?" *Science, Technology, & Human Values* 5(1):87-119.
- Harkness, J. A. (Eds.). 1998. *Cross-Cultural Survey Equivalence*. Mannheim: ZUMA-Nachrichten Spezial, No.3.
- Harkness, J., van de Vijver, F. J. R., and Johnson, T. P. 2003. "Questionnaire Design in Comparative Research." In *Cross-Cultural Survey Methods. Wiley Series in Survey Methodology*, edited by Harkness, J. A., F. J. R. van de Vijver, and P. P. Mohler. New Jersey: John Wiley and Sons.
- Hudec, O. et al. 2004. "Women as Engineering Students in Slovakia." *Slovak Sociological Review* 6(36):561-576.
- McLean, C. et al. 1996. "Masculinity and the Culture of Engineering." Pp. 32-41 in *Third Australasian Women in Engineering Forum*, edited by University of Technology Sydney.
- Porst, R. 1998. „Im Vorfeld der Befragung: Planung, Fragebogenentwicklung, Pretesting.“ *ZUMA-Arbeitsbericht* 98/02.
- Sagebiel, F. 2004. *Masculinities' als Barrieren für angehende Ingenieurinnen in Europa?* Konferenzdokumentation 30. Kongress von Frauen in Naturwissenschaft und Technik 20.05.- 23.05.2004 in Winterthur. (printing).
- Sagebiel, F., and J. Dahmen. 2005a. "Masculinities in Organisational Cultures in Engineering Education in Europe. Results of European project WomEng." *European Journal of Engineering Education* 2005 (printing).
- Sagebiel, F., and J. Dahmen. 2005b. „Männlichkeiten‘ in der europäischen Ingenieurkultur im EU-Projekt WomEng.“ *Soziale Technik* 1(15):19-21.
- Sagebiel, F., and G. Hoeborn. 2004a. „Kultur in den Ingenieurwissenschaften – Standard und Abweichung“ in *Standardabweichung. Dokumentation* 29, edited by Käthe und Clara e.V. - Verein zur Förderung von Frauen und Mädchen in Naturwissenschaft und Technik. Kongress von Frauen in Naturwissenschaft und Technik 29.05.-01.06.2003 in Berlin. Kirchlinteln.
- Sagebiel, F., and Hoeborn, G. 2004b. „Männlichkeiten in den Ingenieurwissenschaften Europas – Theorie, Empirie und Veränderungspotenziale.“ *Journal* 16:27-37.
- Saris, W. E., and M. Kaase (Hrsg.). 1997. *Eurobarometer: measurement Instruments for Opinions in Europe*. Mannheim: ZUMA-Nachrichten Spezial, Bd.2.
- Simmet-Blomberg, H. 1998. *Interkulturelle Marktforschung im europäischen Transformationsprozess*. Stuttgart.
- Stock, J. 1998. *Potentiale und Dimensionen der Wissensgesellschaft – Auswirkungen auf Bildungsprozesse und Bildungsstrukturen*. Delphi-Befragung 1996/1998, Basel.
- Wächter, C. 2003. *Technik, Bildung und Geschlecht*. München, Wien: Profil Verlag.
- Wajcman, J. 1991. *Feminism Confronts Technology*. Cambridge: Polity Press.
- Warwick, D. P. 1973. „Survey Research and Participant Observation: A Benefit-Cost Analysis.“ Pp. 189-203 in *Comparative Research Methods*, edited by Warwick, D. P. New York: Osherson.