

Wanted: Women Engineers!

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Key words: Engineering Studies, Curricula, Gender Aspects, Women in Surveying.

ABSTRACT

Taking a look into a lecture or seminar in engineering in Germany, one might be forgiven for thinking that technology is a male preserve. In spite of every effort made by universities over the last few years, very little has changed in the basic situation that women are strikingly underrepresented in courses in engineering subjects. More emphasis should be given to the following three questions:

- How can engineering subjects be organized to make them more attractive for women?
- What would the framework conditions have to be like in order to ensure that measures that make such courses more attractive are implemented in the long term?
- How can institutional and curricular barriers, which may exist at universities, be reduced or removed?

It is in this context that the 'Joint Commission for the Reform of Higher Education in Land North-Rhine/Westphalia', Germany appointed an 'Expert Commission on Making University Engineering Courses More Attractive for Women' in mid-1998. A handbook presents the results of the Expert Commission's analyses and its recommendations.

During the German Congress INTERGEO® in September 2001 a panel discussion concerning this subject took place with two members of the Expert Commission, one professor from the University of Essen, Faculty of Surveying and one female student from the University of Bonn, Institute for Surveying.

This paper gives an overview about the results of the handbook and the panel discussion 'Wanted: Women Engineers!'

ZUSAMMENFASSUNG

Der Eindruck, Technik sei männlich, könnte sich leicht einstellen, wenn man in die Lehrveranstaltungen in ingenieurwissenschaftlichen Studiengängen schaut. Trotz aller bisherigen Bemühungen der Hochschulen in den letzten Jahren haben sich die grundsätzlichen Verhältnisse der eklatanten Unterrepräsentanz von Frauen in diesen Studiengängen kaum verändert, so dass umso nachdrücklicher die folgenden Fragen gestellt werden müssen:

- Wie können ingenieurwissenschaftliche Studiengänge so gestaltet werden, dass sie attraktiver für Frauen werden?

- Wie müssten die Rahmenbedingungen gestaltet werden, dass es zu einer nachhaltigen Implementierung von attraktivitätssteigernden Maßnahmen kommt?
- Auf welche Weise können ggf. vorhandene institutionelle und studienplanerische Barrieren in der Hochschule abgebaut oder entfernt werden?

Vor diesem Hintergrund hat die 'Gemeinsame Kommission für die Studienreform in Land Nordrhein-Westfalen' Mitte 1998 eine Sachverständigenkommission 'Steigerung der Attraktivität ingenieurwissenschaftlicher Studiengänge für Frauen (SAtiF)' berufen. In einem Handbuch sind die Untersuchungen und Empfehlungen der Expertenkommission zusammengestellt.

Während der INTERGEO® im September 2001 fand eine Podiumsdiskussion zu diesem Thema statt, an der sich zwei Mitglieder der Expertenkommission, eine Studentin der Universität Bonn, Institut für Geodäsie und ein Professor der Hochschule Essen, Fachbereich Vermessungswesen beteiligten.

Diese Veröffentlichung gibt einen Überblick über die Ergebnisse des Handbuchs und der Podiumsdiskussion 'Ingenieurinnen erwünscht!'.

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1 INTRODUCTION

The publication 'Wanted: Women engineers! Handbook on Making University Courses in Engineering More Attractive for Women' was commissioned by the Joint Commission for the Reform of Higher Education in Land North-Rhine/Westphalia and prepared by the Expert Commission on Making University Engineering Courses More Attractive for Women. The Joint Commission is responsible for the content of this publication which was printed in April 2000.

2 THE HANDBOOK

'The Expert Commission, appointed in 1998, now had the tasks of examining the specific issue of the extent to which tested measures were an appropriate way to motivate more girls to study engineering, to enable women students to complete their degrees and to successfully integrate graduates into work, and, if necessary, of presenting new proposals. A systematic evaluation was to be made of earlier models and pilot projects in the areas of motivating schoolgirls, advising them during their studies, assisting them when they started work and in further training, as well as in changing curricula and learning methods. Furthermore, the Expert Commission was given the job of analysing 'the structural causes or barriers (taking into account financial issues, curricular arrangements and organisational implementation) that stood in the way of measures which had proved successful in pilot projects when these were integrated into the 'normal' run of the courses' [Joint Commission 1998]. On the basis of these analyses, the Commission was to draft specific proposals and recommendations, aimed at implementing measures on a long-term basis and eliminating existing institutional and curricular barriers.' (see pages 13 and 14 of the handbook)

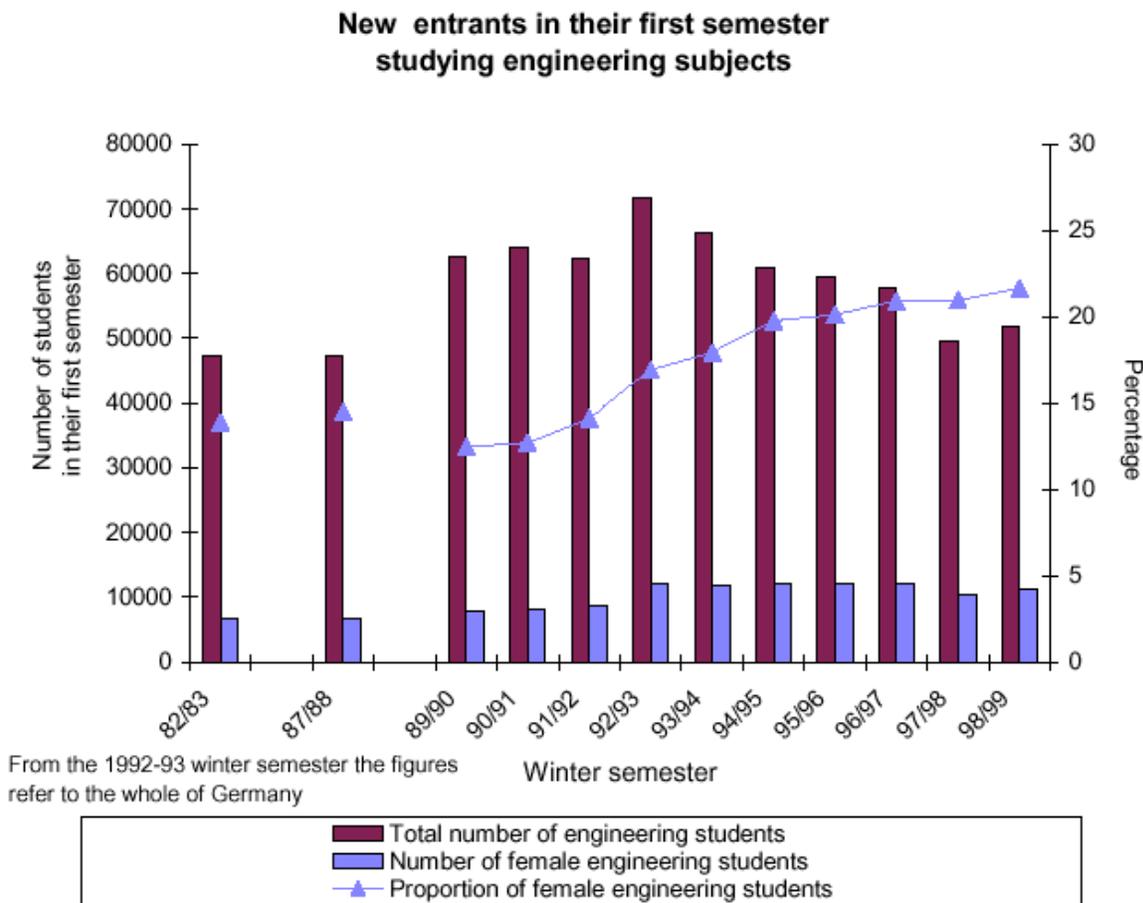
2.1 Women Studying Engineering

'The Diagram 'shows the number of students and the proportion of women entrants on engineering courses. At first glance there appears to be an upward trend in the number of women studying engineering at the start of courses, with the proportion rising from around 12 % to around 22 % over the last ten years. This increase, however, is due on the one hand to a drop in the number of male students of engineering and on the other to an increase in the number of women beginning to study engineering. However, this increase has not been across the board, but only in certain engineering subjects.'

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'The Federal Republic of Germany is thus near the bottom of the European league tables in this respect. Only in Switzerland, Austria, Luxembourg and Ireland does a similarly low proportion of women study engineering subjects. These countries have in common a rather conservative attitude to gainful employment for women. France, in contrast, has a long tradition of women studying engineering, and in England there has been a professional

association for women engineers since 1920. In other countries, such as Sweden, but also Portugal and Spain, the proportion of women studying engineering has risen considerably over the last decades. In Portugal, for example, the proportion of women among students in their first semester was 30 % in 1994.’ (see pages 14-16 of the handbook)



2.2 The Approach of the Expert Commission

‘The Expert Commission sees three main reasons why it is necessary for women to be more involved in the engineering profession:

- Because of industry’s and society’s current and especially future requirements, both from the point of view of quantity and quality,
- Because of the need to reform higher education and
- Because of the need to achieve equality between women and men as enshrined in the law, in view of the fact that a social group which makes up more than 50 % of the population currently has hardly any influence on future technological developments.’

‘Business success today is more dependent than ever before on taking customers’ needs into account and on products and production methods which are ecologically and socially

acceptable. There are indications that women software developers are much more willing to take note of the wishes and questions of the users than their male colleagues – a great advantage, not only in development, but also in service and sales [Schade 1997]. Women are less technocentric and are also more likely to see technology in its social context. Women are by no means better engineers per se, but they widen the scope of engineering in important and necessary ways.’

‘The reform of higher education is thus closely linked with an increase in the proportion of women students. The participation of larger numbers of women in engineering courses is thus not just a question of equality, but also of course content and quality. The third reason for involving more women in engineering is - last but not least – the principle of equality enshrined in the Basic Law. In view of the decisive role of technology in society and its influence on daily life, the non-participation of women means that they are excluded from an important source of power. At the same time social conditions and the interests and experience of those involved in developing technology have an influence on the shape that development takes. If women are excluded, their interests and experience can only be brought to bear indirectly, if at all. There are many positive and negative examples of this. From the point of view of society as a whole, too, it would be desirable for as many different interests and aspects as possible to be included at an early juncture, as different groups of people may be affected by the impact of technology in a variety of different ways. This is more likely to lead to the discovery of new, creative solutions [Erlemann 1989, Greif/Stein 1996].

The Expert Commission believes that formulating partial goals is not enough – in this context to increase the proportion of women studying engineering subjects – but that partial goals of this kind must be harmonised with other partial goals, and the criteria according to which places are awarded must be consistently formulated.’ (see pages 20-23 of the handbook)

2.3 Analysis: Why do So Few Women Study Engineering Subjects?

2.3.1 Vocational Image

‘The vocational image of the typical engineer and the structures of engineering courses and careers are counterproductive to attracting young women.

Decades of single-sex education in technical training and engineering courses in West Germany have created an apparently unbreakable link between technical competence and masculinity [Winker / Oechtering 1998]. In the public mind, the vocational image is characterised by traditional ideas of the vocation, traditional advertising for technical products, and traditional structures within vocational associations, with role models being exclusively masculine, both in their function and the way in which they are presented. In combination, these elements send a clear signal to (young) women that this is not their community, this is not where they belong.’ (see page 25 of the handbook)

2.3.2 Home Background

‘Parents send out mixed messages.

Wide-ranging studies of the influence of parents on girls' career choices indicate that their attitudes are fraught with contradictions. On the one hand, parents formulate educative goals which include all possible careers. Just as for their sons, they would like their daughters to have a secure, crisis-proof job in which they can earn a living long-term and which also offers opportunities for promotion and development [Hoose/Vorholt 1996]. On the other hand, their perception of their children's skills and abilities is gender-specific, in that they attribute mainly social, communicative and linguistic/foreign-language abilities to their daughters, for example, and overlook their achievements in maths and science subjects.' (see page 27 of the handbook)

2.3.3 Socialisation

'Self-confidence in mathematical achievements and the application of these achievements to study and job perspectives are lacking.

Studies of the career choices of young women with ability in maths and science subjects show that girls achieving very good or good results in mathematics at school as a rule rarely decide to apply these skills to a course in engineering or an engineering career [Hoeltje et al 1995, Roloff/ Evertz 1992].' (see page 27 of the handbook)

2.3.4 Training Traditions

'For decades, an education in engineering has been equivalent to an all-male education. This has a negative impact on applications from potential women students.

Few women relish the prospect of fighting a permanent battle single-handedly. Most schoolgirls are aware of their minority situation and its personal consequences in technical training courses, university courses and careers and they make their choice of training and/or higher education course in full awareness and anticipation of these envisaged (and often real) problems relating to the future. Very often, women choose not to study engineering because of the problems they would anticipate or envisage during their studies.' (see page 28 of the handbook)

2.3.5 Training Forms and Contents

'The training contents and objectives and the training environment do not appeal to young people with interdisciplinary, social and linguistic interests.

In our society, technical training courses and technical products are still too closely linked with technical optimisation and the exploitation of every technical facet. Technology seems to regard making everything go 'faster, higher and further' as having priority over 'its effects on health and the environment, and sustainability in development, production and disposal'. For decades, interdisciplinary aspects (linguistic, economic, ecological studies) had a shadowy existence as 'non-specialist' classes, elective or non-compulsory classes [Minks 1996, Stein 1997].' (see page 29 and 30 of the handbook)

2.3.6 Role Models

‘Women are not sufficiently involved in developing and designing technical training and products – there are few role models.

In a recent study carried out by the VDE on young people (5,500 grammar school pupils), 38 % of the male pupils taking advanced courses in maths, physics and information technology were enthusiastic about computer technology and chip development, as opposed to only 8 % of the female pupils [VDE 1998]. American studies on the question as to the options and fantasies girls and boys, women and men associate with technological development note conspicuous differences. Whereas women tend to regard technical equipment in terms of the link it provides between their public and private lives and see it in the context of human relationships, men see its function as being to extend and/or enhance their physical power and control over speed, other people and knowledge [Honey et al 1991].’ (see pages 31 and 32 of the handbook)

2.3.7 The Situation on the Job Market

‘Facts about the career situation are discouraging – experience shows that having the courage to enter a male-dominated area is often not worth the effort.’

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‘Detailed evaluation of a sample census and statistics relating to women engineers reveals lower pay, fewer promotion opportunities, a higher risk of unemployment, and lower acceptance in their careers compared to men [Minks 1996, Tischer 1999]. Many members of university teaching staff report on positive experiences and observations concerning the start and development of the careers of women graduates who studied core technical subjects.’ (see pages 32 and 33 of the handbook)

2.4 Recommendations of the Expert Commission

‘In order to fulfil this task by making engineering courses more attractive to women, the Expert Commission sees a specific need for action to be taken in various areas and makes the following recommendations:

- Industry and professional associations have called for engineering courses to cover a wider spectrum of qualifications in future. To achieve this, there should be a stronger focus on communication, team and organisational skills. Curricular contents and teaching methods should be adapted to these new demands.
- In order to develop a wide range of qualifications, the starting point must be to harness a greater variety of interests and talents. Training concepts must therefore better accommodate more heterogeneous groups of students who may be recruited in future.
- In the context of current engineering courses, which, to oversimplify, are structured to cater exclusively for the talents and interests of men, it is recommended that, at least for a transition period, single-sex course elements, study facilities or courses are provided for women in cases where general reforms have not taken place.

- Courses should begin in a way that promotes the interest of women students. They should be preceded by information events in schools and institutes of higher education, with parents and teachers being informed at as early a date and as comprehensively as possible. Specific provisions should be made for guidance during university and gender-specific aspects should be taken into account in course design. These are the main factors influencing the attractiveness for women of courses in engineering. Universities and departments are called upon to integrate relevant measures in an overall concept for the specific institute of higher education and to ensure their broad implementation.
- Both the Land and institutes of higher education should develop a system of tangible financial incentives to reward an increase in the proportion of women teaching staff and students in engineering and science subjects. This could be in the context of agreed objectives or the integration of relevant indicators in the item-linked allocation of funding. In addition it is recommended that an innovation fund be established for the further development of existing measures and the development of new measures.
- Universities, industry and professional associations are called upon to enter into intensive cooperation to support the transition of women graduates from university onto the employment market and, by means of flanking measures, to contribute to the success of their careers. Here, as at federal level, it is necessary to enter into cooperations within a Land or within a region.’ (see page 75 and 76 of the handbook)

3 PANEL DISCUSSION ”WANTED: WOMEN ENGINEERS!”

During the German Congress INTERGEO® in September 2001 the Working Group ‘Women in Surveying’ (AG FiV) of the German Association of Surveyors DVW organised a panel discussion concerning this handbook. The AG FiV has been dealing with this subject since several years, because one of the AG FiV goals is to increase the number of female surveying students.

3.1 Participants



Prof. Dr. Bernd-Josef Schumacher from the University of applied Science of Bielefeld, Faculty of Electrical Engineering and Information Technology and member of the ‘Expert Commission on Making University Engineering Courses More Attractive for Women’;

Dipl.-Ing. Gabriele Drechsel, Gender Equality Commissioner at the University of applied Science of Cologne and member of the 'Expert Commission on Making University Engineering Courses More Attractive for Women';



Ariane Middel, Student at the University of Bonn, Institute for Surveying;
Prof. Dr. Heinz-Jürgen Przybilla from the University of Essen, Faculty of Surveying;



Dipl.-Ing. Regina Kistermann-Stötzel, Surveyor and member of the AG FiV, who moderated the discussion.

Preparing the discussion Regina Kistermann-Stötzel asked her daughter and 2 friends of her (all 12th year of secondary school – approximately 18 year old), what do they think about the engineering profession. They answered that technique is stodgy with too little diversification and contact with people and that the school had put off their interest for natural science (mathematics, physics). All three neither have any problems with prejudices and the dominance of men in the engineering profession nor with the compatibility of carrier and family. In case they will decide to join the engineering profession they are sure to find their way into it. About technical studies only for women they think that this will only shift the problems into the professional life. For these three young women the diversity of engineering professions is unimaginable. They think that it is necessary to educate at school that engineering is very important for the society, to put aside prejudices and to clarify the areas of work for example with project oriented classes.

3.2 Some Statements

Prof. Bernd-Josef Schumacher stated, that it is necessary to establish a new profile of engineering studies because engineers nowadays shall be more flexible reacting instantly to customers demands. He reported about a new course of study 'Energy Marketing' in the Faculty of Electrical Engineering with practical training only for female students. It is important for women to develop their own personality which is not possible with 3 female students of 100.

Gabriele Drechsel pointed out that all activities and measures to increase the number of female students have to be credible: the structure of studies, the professors and lecturers and

the marketing. She presented several examples from the handbook how to motivate women to study engineering and to support them at university.

Ariane Middel reported about her own situation at the Institute of Surveying at the University of Bonn. In her semester are 22 % female students. Because of a lack of male students the percentage increased now to 30 %. In her opinion it is not profitable to establish courses of surveying studies only for women and she for herself prefers mixed teams during the practical training. Besides this she stated, that it is very important to improve the careers guidance.

Prof. Heinz-Jürgen Przybilla noted, that decreasing numbers of surveying students demand a look on the target groups which shall be addressed with the courses of study. Female students finish their studies earlier and they study more consequently. Therefore women should be enhanced to study engineering. Contrary to the expectation that the number of female students increased with the new course of study 'Geoinformatic' the percentage decreased from 22.7 % in surveying study to 20.7 % in geoinformatic. This has to be evaluated.

4 SUMMERY

'For future design processes, economic success, social development and innovation, the competencies and skills of all are required. Especially in the field of technological and scientific careers, where there is a high level of demand for labour, not least in the interest of increasing competitiveness, the potential of women has been only partially tapped. At the same time, technical specialists and managers now require different skills, and competencies are increasingly in demand which are more commonly attributed to women on account of the socialisation process they have undergone. It is a task and a challenge for universities to support women in taking the initiative in using their competencies and skills and implementing measures to bring about equal opportunities for the careers development of men and women.' (see page 75 of the handbook)

REFERENCES

- Erlemann, C., 1989:** Das Technische ist politisch - Frauen als Subjekte der Technologieentwicklung. In: Forum Wissenschaft, Nr. 4, S. 30-34
- Greif, M./ Stein, K., 1996:** Ingenieurinnen. Daniela Düsentrieb oder Florence Nightingale der Technik. Nut – Frauen in Naturwissenschaft und Technik e.V. Schriftenreihe, Bd. 3. Mössingen-Talheim: Talheimer Verlag
- Hoeltje, B. et al, 1995:** Wider den heimlichen Lehrplan. Bausteine und Methoden einer reflektierten Koedukation. Bielefeld: Kleine Verlag
- Honey, M. et al, 1991:** Girls and Design: Exploring the Question of Technological Imagination. CTE Technical report Issue No. 17, Center for Children and Technology, Bank Street College of Education
- Hoose, D./ Vorholt, D., 1996:** Sicher sind wir wichtig – irgendwie!/? Der Einfluß von Eltern auf das Berufswahlverhalten von Mädchen. Eine Untersuchung im Auftrag des Senatsamtes für Gleichstellung Freie und Hansestadt Hamburg. Wuppertal: Denkbar

- Joint Commission, 1998:** Arbeitsauftrag für die Sachverständigenkommission SATiF 'Steigerung der Attraktivität ingenieurwissenschaftlicher Studiengänge für Frauen', Gemeinsame Kommission für die Studienreform im Land Nordrhein-Westfalen, Drs. 98/009
- Minks, K.-H., 1996:** Frauen aus technischen und naturwissenschaftlichen Studiengängen. Ein Vergleich der Berufsübergänge von Absolventinnen und Absolventen. HIS, Hochschul-Informationssystem, Hochschulplanung, Bd. 116, Hannover
- Roloff, C./ Evertz, B., 1992:** Ingenieurin (k)eine lebbare Zukunft. Vor-Urteile im Umfeld von Gymnasiastinnen an der Schwelle der Leistungswahl. Weinheim: Deutscher Studien Verlag
- Schade, G., 1997:** Die Wirkung 'weiblicher Kompetenzen' im Software-Entwicklungsprozess, in: TH Illmenau (Hrsg.) : Entwicklung und Einsatz von informationstechnischen Lösungen - auch eine Frage des Geschlechts? Illmenau
- Stein, K., 1997:** Berufsbild und Berufsmotivation der IngenieurInnen. In: Neef, W./Pelz, Th., 1997: Ingenieurinnen und Ingenieure für die Zukunft. Aktuelle Entwicklungen von Ingenieurarbeit und Ingenieurausbildung. Berlin: Zentraleinrichtung Kooperation der TU Berlin
- Tischer, U., 1999:** Situation und Tendenzen auf dem Arbeitsmarkt für Ingenieurinnen. Nürnberg: Bundesanstalt für Arbeit, Referat für Frauenbelange
- VDE (Hrsg.), 1998:** VDE Jugendstudie. Im Internet unter <http://www.vde.de/vde/html/d/young/techclub/jugend1.htm>
- Winker, G./ Oechtering, V. (Hrsg.), 1998:** Computernetze – Frauenplätze. Frauen in der Informationsgesellschaft. Opladen: Leske + Budrich
- Wissenschaftliches Sekretariat für die Studienreform im Land Nordrhein-Westfalen (Publisher), 2000:** Wanted: Women engineers!, Bochum; www.wss.nrw.de "Publikationen", "Gemeinsame Kommission"
- Wissenschaftliches Sekretariat für die Studienreform im Land Nordrhein-Westfalen (Publisher), 2000:** Ingenieurinnen erwünscht!, Bochum, www.wss.nrw.de "Publikationen", "Gemeinsame Kommission"

BIOGRAPHICAL NOTES

Gabriele Dasse (41), has been chair of the FIG Task Force on 'Under-represented Groups in Surveying' since February 1998 and member of the Task Force 'Review of Commission, Task Force and Permanent Institution Structure 2000–2002'. She studied surveying in Germany at the University of Applied Science in Hamburg with the main emphasis on Photogrammetry. After practising one year in a private company she started working for the Department for Geoinformation and Surveying in Hamburg. At the moment she is responsible for regulations and instructions.

From 1991 to 1996 she held the office as Gender Equality Commissioner for the entire authority (both jobs 50 % part time) with 1600 employees and a share of 25 % women. As one result of her activities Gabriele was nominated by the Green Party and elected as member of the Hamburg Parliament from 1993 to 1997. She was the speaker of women's affairs of the parliamentary party.

Since 1990 Gabriele Dasse has been member of the working group 'Women in Surveying' in the German Association of Surveyors DVW (member of FIG) and speaker of this group since 1995. Gabriele Dasse has been member of Commission 1 (Professional Practice, Organisation and Legal Basis) of DVW since 1998.