



WOMEN in COstruction scientific REsearch

WOMEN-CORE
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EXECUTIVE SUMMARY WOMEN-CORE CONCLUSION

Abstract:

This report presents an executive summary of the main conclusions from the WOMEN-CORE project. The WOMEN-CORE project was established to address the under-representation of women working in construction-related research.

WOMEN-CORE was co-funded by the European Commission's Research Directorate General (DG Research, Women and Science Unit). The project ran from April 2006 to December 2008 and aimed to address the unequal representation of men and women in construction research in Europe by enhancing the knowledge on women and strengthening their participation in construction.

For further information about the WOMEN-CORE project and consortium members, please visit the project website: <http://www.women-core.org>

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1. INTRODUCTION

Many different existing sources of information together with a wide variety of new sources have been exploited in the WOMEN-CORE project in order to improve the knowledge base of women in construction research from three different targets: individuals, institutions and content of research.

The consortium would particularly like to highlight the difficulties found throughout the research in the WOMEN-CORE project concerning the lack of sex-disaggregated data in many of the sources of information consulted, even in official databases like FP5 and FP6 research projects or the European Patent Organisation (EPO), where gender is not registered on patent applications. The project had to create a database of European first names to solve in part these difficulties.

The main characteristics of the scientific career in construction research and the most relevant trends that shape the professional development of construction researchers have been identified. Significant differences between women and men have arisen as key issues with relevant implications with regard to professional continuity and success.

Research institutions, through institutional practices and structures, play a relevant role that can either enhance or minimise gender inequality. Policies implemented to attract, retain and promote women as researchers, as well as measures for work/life balance, targets and quotas have been identified and analysed in order to define and recommend suitable initiatives to increase gender equality.

Results from the mapping of construction research have shown actual changes in the content of research, including fields which are less male-dominated and often focused on environmental and socially-sensitive issues. The emergence of these new fields may constitute a good opportunity for changing old-fashioned structures and encourage a higher participation of women in construction research, although this could also be a source of horizontal segregation.

General conclusions from the analysis are presented.

2. WHAT PROPORTION OF CONSTRUCTION RESEARCHERS ARE WOMEN?

Several key findings can be highlighted regarding the women's representation in higher education, the highly qualified population among scientists and engineers, and the women's participation in EU funded projects, patenting, publication and citation:

2.1. Gender educational segregation

- *In 2004, women were found to account for 40.7% of bachelor and masters graduates and 33.9% of doctoral graduates in construction-related fields.* It is higher than the proportion of women graduates in science and engineering. This may be because construction-related study includes architecture which tends to be less male dominated than other science and engineering subjects. The proportion of women graduating in construction is increasing.

2.2. Vertical and horizontal segregation in construction research

- *In 2005, women only accounted for 19% of scientists and engineers in construction research,* although there has been a positive increase between 2000 and 2005 (2.9 percentage point – p.p.). Scientists and engineers are understood to be employees working in the most R&D oriented occupations. In construction these are scientists and engineers working in occupations most related to construction research (architects, engineers, physicists, chemists and related professionals).
- *In 2006, women represented only 18% of the total membership within the ECTP.* Most of these women were engineers with a PhD and experienced researchers. Women were especially represented in public administration (28%) as well as in research bodies (23%). On the contrary, women's participation in industry was very low, accounting only for 15%.
- *Vertical segregation is strong, with high proportions of women studying construction subjects in higher education, but much smaller proportions of women in more senior positions.* However, it is also important to consider that any increase in women in more junior positions will take some time to be seen in more senior roles, as they develop when these women develop their careers.
- *Horizontal segregation is salient with regard to the R&D field:* women work in a higher proportion at institutions that perform R&D activities in the fields of architecture, urban planning and other non-classified activities, while men do so in a higher proportion at institutions working in ICT and mechanics research, including fluid mechanics and dynamics.

2.3. Women's participation in EU funded projects

- *In FP6 (2003-2006), women represented 11.2% of coordinators and scientific managers of construction research projects funded by the EU. On average, the proportion of women coordinators and scientific managers participating in EU funded construction research projects has increased from FP5 (1998-2001) to FP6 (2002-2006) by 4.6 p.p.; although there was great variation between countries.*

2.4. Women's participation in patents

- *In 2004, women comprised only 4.9% of patentees in the construction sector. Patenting is less common in the construction sector compared to the chemical and pharmaceutical sectors. Women patentees were found to be very poorly represented in all sectors analysed, but particularly in the construction sector (4.9%) compared to the chemical (10.2%) and pharmaceutical (17.3%) sectors. On average there was an increase of 1.2 p.p. in the proportion of women patentees between 1994-2004, with variation across countries.*

2.5. Women's participation in publication and citation

- *In 2003, women accounted for 21.7% of publishing authors in scientific journals related to construction. Most of authors were based in HEI, with only 21.8% of authors affiliated to non-university organisations in 2003. Women publishing in construction scientific journals increased 7.0 p.p. between 2000 and 2003, with high variation between journals. Women may be more successful in subjects related to 'softer' issues within the construction sector, such as the environment and architecture, rather than the 'harder' engineering based elements.*

3. DO NATIONAL DIFFERENCES EXIST?

3.1. Countries differences in women's participation in construction research

- *Overall, the countries with the highest proportions of women participating across all areas of construction research are countries where the total number of people involved in construction research is very small. For example, Lithuania has the highest proportion of women involved in construction patents (23.0%), but only accounted for 113 patents between 1994 and 2004, compared to over 150,000 in Germany.*

3.2. National trends in the WOMEN-CORE partner countries

- *The UK (-0.2 p.p.¹), the Czech Republic (-0.4 p.p.) and Denmark (-6.5 p.p.) all experienced decreases in the proportion of women scientists and engineers in construction research between 2000-2005;*
- *The Czech Republic (10.6 p.p.) and Spain (12.5 p.p.) both experienced higher than average (4.6 p.p.) increases in the proportion of women working as coordinators or scientific managers of EU funded construction projects between FP5-FP6;*
- *The UK experienced decreases in the proportion of women in many of the indicators: scientists and engineers in construction research (-0.2 p.p.); coordinators and scientific managers in EU funded construction projects (-1.1 p.p.); and patentees in the construction sector (-0.3 p.p.).*
- *However, there was an increase in the proportion of women publishing in construction scientific journals (10.9 p.p.) which may be due to the importance of scientific publication to both career progression and research funding in UK academia;*
- *Spain experienced a lower than average increase in the proportion of women publishing in scientific journals related to construction (4.7 p.p., compared to average 7.0 p.p.) between 2000 and 2003. All other partners' countries experienced a higher than average increase, which was particularly noteworthy in the Czech Republic (22.4 p.p.).*

¹ Percentage points

4. ARE THERE DIFFERENCES BETWEEN ACADEMIA AND INDUSTRY?

4.1. Women's presence in Industry

- *Industry has the lowest proportion of female construction researchers.* Research centres have the highest proportion of women construction researchers compared to industry and higher education institutions (31%, among the institutions surveyed). Although in Industry there were less women construction researchers (25%) there is a higher proportion of women within construction research than among their general staff.
- *With regard to horizontal segregation, differences between academic and industrial sectors were found.* Higher education institutions have the best proportion of women in construction research and the best profile on gender equality measures. The difference in the proportion of women involved in publishing (21.7%) compared to patenting (4.9%) may also indicate that women are better represented in construction research in academia rather than industry. It is likely that the emphasis on publishing may be higher in academia, while industry has more focus on the commercial impact of research.
- *Patterns of horizontal gender segregation were found from the survey to individuals.* Women are slightly under-represented in industrial research: While the presence of women is 44% among the construction researchers who work in the academic sector, the figure is only 34% among those working in industrial research.

4.2. Horizontal and vertical segregation

- *Horizontal segregation is salient with regard to the R&D field:* women work in a higher proportion at institutions that perform R&D activities in the fields of architecture, urban planning and other non-classified activities, while men do so in a higher proportion at institutions working in ICT and mechanics research, including fluid mechanics and dynamics.
- There have also been significant patterns of vertical segregation. Only 24% of female researchers are found in the highest level of expertise whilst 34% are in the lowest levels. For men, these percentages are 31% and 23% respectively. Patterns of vertical segregation also emerge regarding promotions. 26% of female researchers have been promoted three or more times in the past ten years, compared with 37% of men.

4.3. Patterns of seniority

- *The proportion of women decreases by level of seniority.* Industrial companies have a steady decline of women construction researchers. The survey found a decrease of 22.3 p.p. of women from level 4 to level 1, compared to the average decrease of 12.5 p.p. There are some indications of a direct relationship between the proportion of senior women and the proportion of junior women in the same institution. This could mean that women graduates are attracted to institutions that have a high proportion of women employees.

5. ARE RESEARCH INSTITUTIONAL PRACTICES HELPING TO ACHIEVE GENDER EQUALITY?

5.1. Retaining women policies

- *The departments of HEI and research centres have the highest proportion of women staff and also the highest frequency (generally) of gender equality measures.* The institutions' attention towards gender equality is to some extent reflected in the proportion of all staff in the categories.
- *Research centers appear to be better at retaining women construction researchers* than other types of institutions with a high proportion of more senior women construction researchers.

5.2. Working conditions

- *In industrial research there are more permanent contracts whereas the use of fixed-term contracts is more widespread in academia,* without differences between women and men.
- *The use of part-time contracts is more widespread in academia than in industrial research* and in both institutional sectors, the proportion of women working part-time is far higher than men's, with almost no male researchers working-part time in industry.
- *Whereas salaries tend to be higher in industrial than in academic research there is a relevant gender pay gap in both institutional sectors,* which appears to be larger in industrial research.

5.3. Work-life balance and gender equality measures

- *Views, perceptions and satisfaction on work-life balance are similar in industrial and academic research and these accounts for both female and male construction researchers.*
- *The Higher education institutions (HEI) have the best profile on gender equality measures. Gender equality measures are implemented in all categories of institutions, but the extent of implementation varies, depending on the kind of measures and category of institution. Higher Education Institutions reported the implementation of the highest number of measures for enhancing gender equality.*
- *Work/life balance measures, such as flexible working hours, the ability to work from home and informal mentoring schemes are the most prevalent equality measures. Quotas are least prevalent.*

6. RELEVANCE OF OTHER SUPPORTING PRACTICES

6.1. Mentoring relevance and experiences

- *Both women and men surveyed agreed that mentoring is an important instrument for promoting the research careers in construction research. A very positive perception was generally felt about the influence of mentoring on career progression in construction research, with benefits described for both mentor and mentee. However, women were found to be slightly more interested in the mentoring experience than men.*
- *Women are over-represented among those who had female mentors in both formal and informal mentoring.*
- *Informal mentoring was very prevalent in construction research, instead of formal mentoring. Differences among countries were found in relation to participation in formal mentoring programmes. Participants from Germany and United Kingdom mentioned experience in established mentoring programmes (in academia and in large enterprises, respectively), while in Spain no interviewee participated in formal mentoring.*
- *Researchers had more frequent experiences as mentor than non-researchers in construction sector.*

6.2. Mentoring programmes

- *There is only a small number of mentoring programmes related to construction in Europe.* The number of mentoring programmes covering different areas is increasing all around Europe, but, there is only a small number of mentoring programmes related to construction in Europe and even a smaller number is focused on supporting women in construction and construction research.
- *HEI concentrate the highest number of mentoring programmes.* Most of the mentoring programmes are located at universities, exceptionally in large construction companies. The small number of mentoring programmes in the construction industry opens possibilities for future mentoring programmes and for higher retention of talents in the field. Recently, there has been an increase in mentoring programmes, particularly mentoring programmes for women as gender equality becomes more recognised, but not specifically in construction sector.
- *There are no standards for mentoring programmes.* While there has been an increase in mentoring programmes all around Europe, there are no set rules for mentoring programmes, nor there are generally accepted accreditation and evaluation systems. Development of common rules and widely acceptable accreditation and evaluation systems are one of the crucial requirements not only for establishing new mentoring programmes, but also for keeping the programmes running for a long period of time and with high-level quality.

6.3. Role models

- *Role models are important for the career of young women,* according to many participants across the selected institutions and countries.
- *There are hardly any role models for women available* and if so it happens more on an informal basis. The biggest problem for the implementation of this measure seems to be the lack of appropriate women in some sectors. Only some of the selected institutions have a few individuals who act informally as role models.

6.4. Networking experiences in construction research

- *The influence of networking was perceived as very positive in career progression in construction research,* although women showed slightly more interest in it. Successful networking can positively influence career outcomes such as increased job opportunities, job

performance, income, promotions and career satisfaction, gaining visibility, career advice, social support, business leads, collaboration and professional support. Some specific benefits of networks for women include the opportunity to be in a non-male environment; to spend time with role models or women who have 'made it' in a male environment; to support other women and provide reassurance and validation that workplace problems are not specific to them.

- *A high participation in professional networks has been detected* with minor differences between women and men. The opportunity to develop useful contacts and obtain information and knowledge were seen as the main benefits of networking.
- *High levels of satisfaction with existing networks were found.* However, while organisations state that they support and facilitate networking, individuals indicate that they do not have adequate time for networking. Some differences among countries were found. Interviewees from UK are most likely to participate in networks in general and in networks for construction researchers in particular, and the Spanish participants are least likely. This could be explained because UK is most likely to set up networks for construction researchers.
- *A network specifically for construction researchers was considered a good idea,* although there were reservations about how successful this would be if it was exclusive to women.

7. ARE PUBLICATIONS AND PATENTS EFFECTIVE FOR PROGRESSING IN CONSTRUCTION RESEARCH CAREERS?

7.1. Significance of publications and peer review in construction research careers

- *Scientific publications are very valuable in construction research.* Construction researchers perceived scientific publications as very valuable and relevant for their professional career without significant divide between female and male. However, differences between academia and industry were found: publications were very important for those researchers working in academia and in research centres, and they represented a lesser priority for participants working for industry, and for non-researchers.
- *There is no significant difference between female and male construction research with respect to scientific publication,* in terms of number of articles accepted and rejected or papers presented at conferences, as well as participation in peer-review in scientific journals. According to the findings of D24 males are overrepresented in publication of

articles.

- *Neither editors, authors nor reviewers perceived any gender bias in the peer review process.* The peer review process was generally felt to be a lengthy process but most construction researchers accepted it as the best alternative in spite of its weaknesses. In general, female authors were less satisfied with the peer review system and feedback than males, but gender biases were not mentioned at all. Although “blind peer review” was seen as a way to improve the peer review process, there were controversial opinions about how to improve it. While some authors thought that reviewers are not always experienced enough in the field to review the paper, others mentioned that when one expert is reviewing another the competition between them might result in a biased review.

7.2. Significance of patents in construction research careers

- *Women are absolutely under-represented among patent holders in construction.*
- *Patenting was not perceived as necessarily important for the career progression of either sex.* There was no unanimity in perceiving patenting as an experience with positive influence in professional careers. Patenting appears not to be a priority in the professional careers of non-researchers, both female and male. There was a common impression that patenting is more important for the institution than for the researchers themselves. No gender bias was detected.
- *Patenting perceptions did not show significant differences between female and male construction researchers,* in spite of women’s under-representation among patent holders in construction, although women were slightly more uncomfortable with patents than men. None of the interviewees had ever experienced any gender bias.

8. IS THE CONTENT OF CONSTRUCTION RESEARCH GENDERED?

- *In 2006, women’s participation in the ECTP focus area varied significantly.* Women were mostly represented in the Cultural Heritage group, accounting for the 13% of the total representation, followed by Networks (11%), Materials (10%) and Quality of Life (9%). On the contrary, women were scarcely represented in Underground Construction (5%), Cities and Buildings (6%) and Processes and ICTs (7%).
- *Results from the mapping of construction research and fieldwork with individuals have shown actual changes in the content of research, including new fields less male-dominated*

and focused on environmental and social-sensitive issues. New fields of research and approaches are emerging from new social demands, environmental respect and sustainability which may lead to opportunities for women and for other groups traditionally discriminated. The emergence of these new fields may constitute a good opportunity for changing old-fashioned structures and encourage a higher participation of women in construction research, although this could also be a source of horizontal segregation.

9. NETWORK FOR CONSTRUCTION RESEARCHERS

As a result of the WOMEN-CORE project, ENCORE: Equality Network for Construction Researchers in Europe has been established. The network intends to expand the role and contribution of women in industrial and academic construction research,

It is open to all construction-related researchers, including women and men, industry and academia, employers and employees, mentors and mentees, research students and supervisors.

The network provides an opportunity to find out about construction research news, including calls for journal and conference papers, workshops and conference invitations, summaries and links to research and publications, relevant job advertisements (for example, research studentships or research positions) and, funding opportunities. It will also be an opportunity to engage in lively discussion and debate with other construction researchers across Europe and beyond.

More information about the network can be found at: <http://encore.lboro.ac.uk> and individuals can sign up for the discussion forum at: http://tech.groups.yahoo.com/group/en_core/