

## Women in Science and Engineering – A Greek Experience

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### Abstract

During the last century, women have made an impressive progress in society, education and the workplace, increasing considerably their participation in historically male-dominated fields such as business, law, and health sciences. However, in science and engineering women’s involvement has been less dramatic, and their progress in the respective workplace (especially senior posts and decision making bodies) even slower. In Greece, the cradle of science and philosophy, this situation is even more pronounced. Although Greek women are over-represented in undergraduate studies (more than the European mean), their proportions quickly decrease as one moves up the academic scale. Recent statistical surveys also indicate that this situation may not be adequately apparent, thus more publicity and possibly mainstreaming is required.

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I was invited as a panelist in a special session on “Women in Engineering” in the 12th Mediterranean Conference on Medical and Biological Engineering and Computing (MEDICON 2010), held under the auspices of the International Federation of Medical and Biological Engineering (IFMBE) in Chalkidiki, Greece. Considering that in the western tradition ancient Greek philosophy is regarded the establishment of science, the conference and session chairs, Prof. Nicolas Pallikarakis and Prof. Monique Frize respectively, thought that the Greek reality on women in science and engineering should be also presented, preferably by a Greek person. The invitation was a surprise. I’m a woman, and I consider myself a scientist in the field of biomedical engineering and informatics, and this is where my relevance to the topic of this panel would end a few months ago. So I took up the challenge in awe, and during this engagement a number of interesting findings came up, some of which I would like to share here as part of this paper.

In the western tradition, physical philosophy and thus science are believed to have originated in ancient Greece. Although there are considerable differences (and remarkable exceptions), across the ancient

Greek world of historic times women were mostly restrained at home, under the oppression of men (father, then husband), not allowed to participate in social and political activities, solely relegated to child bearing [1,5]. However, interestingly enough there was an equal men/women representation in the Greek pantheon and an indirect but significant political influence by the hetaerae, accomplished female companions who received good education and enjoyed considerable freedom. Moreover, although not many historical references exist, it is known that there was significant involvement of women in the making of philosophy and mathematics. A striking example is the Pythagorean School where women entered on an equal basis with men [1,7]. Pythagoras himself was surrounded by women. His teacher was Themistocleia, a Delphic priestess, and his wife, Theano, was a mathematician herself and the director of the School after Pythagoras' death. Three of their daughters, Damo, Myia and Arignote were also distinguished mathematicians and philosophers. Later, Pythagorean women include Periktione, who is commonly identified as Plato's mother, and the well known mathematician and astronomer Hypatia of Alexandria in the 4<sup>th</sup> century AC.

Greece today is still mostly a patriarchal society, but there are continuous improvements on gender equality due to women's obligatory education and the overall socio-economic development. There is no specific gender mainstreaming plan, but rather a general gender equality plan. For example, an enactment of 2000 on equal gender treatment requires that a minimum of 1/3 of each gender be represented in all public decision-making bodies. On the basis of specific initiatives in Greece, today there are considerably more than 100 societies dealing with gender equality and related issues.

According to an official report from the Greek Ministry of Development [4], during the past 50 years there is an impressive increase of women's representation in the educational system and a gradual reduction of the gender gap. While in 1969-1970 women were only 31% of the total undergraduate university population, thirty years later they prevailed over men, i.e. 59% women undergraduates in 2000-2001. Women constitute almost half of the student population of the Technological Institutions and gradually start prevailing over men: 50% in 1994 and 53% in 1998. Although gender-based differences in student's participation in various scientific fields are being reduced, a difference among sciences still exists. Thus, in Humanities, Arts, Law and Social Sciences women outnumber men. Women's participation in the Natural Sciences has increased significantly, increasing from 20% in 1971 to 43% in 1997. Finally, in the field of engineering, the women's ratio increased from 6% to 25% during the same period. In 2004 Greece was one of the seven European countries (Bulgaria, Portugal, the Former Yugoslav Republic of Macedonia, Lithuania, Estonia and Romania being the other six) that had reached the point at which one third of women graduates in engineering were women [6] – a level that the European Commission had suggested as the target for 2010.

Indeed, in the year 2006 the Periktione Network, a newly founded women researchers' network under the auspices of the General Secretariat for Research and Development, Ministry of Development, conducted a statistical research among 2.200 women in 50 Greek research institutions (description and results are available from National official site for mapping women researchers in Greece, <http://ereunities.ekt.gr/ereunities/>). The majority of the responders were active in the social sciences and humanities, 34% in medical sciences, 12% in natural sciences and only 4% in engineering and technology. The survey also highlighted the fact that only 20% of the women responders were participating in management organizations, while a mere 10% had been appointed as a national representative in EU and/or national institutions. The quantitative part of the same survey showed that the majority of women (67%) do not experience direct gender discrimination in the workplace, while indirect gender discrimination was mentioned mostly by elder women researchers (%33). More than 50% of the survey participants realize that women do face more problems, and they mainly attribute these to time

overload due to concurrent family commitments. Actually the majority admits that their role as active researchers interferes with their family and vice versa. For these reasons, more than 66% consider gender to be an impediment to their career advancement. However, despite all of the above issues, it is striking that the majority of survey participants report very good working relationships with their male colleagues and they are satisfied or very satisfied by their choice of profession.

This registered contentment could probably be explained by looking at the relative figures for Greece and the rest of European Union States. As indicated by recent official European Union (EU) data [2,6] (indicative figures summarized in

Table 1), the proportion of women graduates in tertiary education in Greece is around 62%, higher than the EU mean. Moreover, the proportion of women graduates in engineering, manufacturing and construction in Greece is 45%. This figure is much higher than the EU mean and actually is the maximum for the EU countries. Although the figures are not as positive for the proportion of women researchers in general, and per sector (namely, higher education, government, business), the figures for Greece are still higher than the EU mean. However, the situation is reversed when women proportions in senior research positions are considered. What is known as the “leaky pipeline”, (i.e. the fact that the proportion of women declined significantly as they moved towards higher levels in the academic and research career) is more pronounced in Greece than in the EU. For example, the statistical data shows that in 2004 only 11% women were Grade A professors in Greece as opposed to 13% EU mean (which is still a low figure).

Table 1				
	Greece	EU mean	EU max	EU min
proportion of women graduates in tertiary education (2004) [6]	62%	59%	77% Cyprus	30% Bosnia & H.
proportion of women graduates in engineering, manufacturing & construction (2004) [6]	45%	26%	45% Greece	13% The Netherlands & Switzerland
proportion of female researchers (2006) [2]	36%	30%	49% Lithouania	18% The Netherlands)
proportion of female researchers in higher education sector (2006) [2]	38%	37%	51% Latvia	25% Malta
proportion of female researchers in the government sector (2006) [2]	41%	39%	64% Malta	29% The Netherlands
proportion of female researchers in the business sector (2006)[2]	28%	19%	41% Romania	10% The Netherlands
proportion of women Grade A professors (2004) [6],	11%	13%	29% Romania	8% Ireland

Table 1. Some figures on proportions of women’s participation in research for Greece as opposed to the European Union. The figures are based on statistical data as presented in [2] and [6].

The official national data [8] for a typical academic career (students and staff) in all Greek Universities for the year 2007 is shown in Figure 1. Women make-up 65% of graduate students, and as MSc/MA degree holders, they outnumber men. However, these figures decline rapidly as one advances to higher level positions, with women being only 18% of Grade A professors.

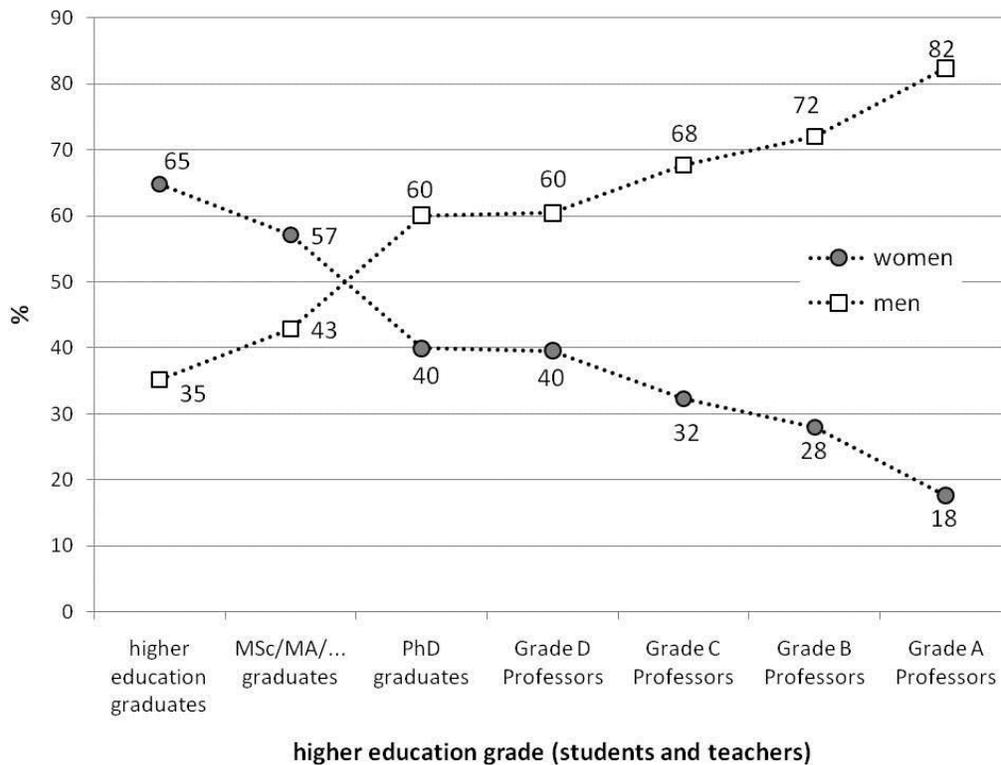


Figure 1. Proportions of men and women in a typical academic career in Greece. The data refers to total numbers of students or academic staff in all Greek Universities at the end of academic year 2006-2007 [8].

So where do we really stand? In recent years, women in Greece were highly and successfully involved in higher education and postgraduate studies, and they are steadily progressing following academic and research careers, even in fields traditionally dominated by men. In their research working environment, they seem to encounter a positive attitude from males and, although they face some gender related difficulties (mainly due to family commitments) they seem satisfied with their research and academic professional life.

To draw an analogy that I used during my speech in the MEDICON Conference in Chalkidiki, at first glance, it seems that Greek women researchers are pleased to be standing amidst a charming Greek scenery. Only they do not seem to be aware that right next to them stands the uniqueness of Mount Athos (The Monastic Community at the Holy Mountain in Chalkidiki, Greece, <http://www.mountathos.gr/>), where no women are allowed to enter. Although the status of Mount Athos is a matter of faith and religion and is not an issue in this very discussion, senior research posts is another matter altogether. The fact that women's representation in science and engineering declines significantly in the senior scientific/academic grades and research decision-making bodies is a European and international

problem, addressed regularly in a number of official reports, e.g. [2,3,6,9]. As stated in the executive summary of the WIRDEM 2008 report [9], “*such a situation must inevitably mean that the individual and collective opinions of women are less likely to be voiced in policy and decision-making processes, which may lead to biased decision-making on topics of future research*”. And this most likely leads to a vicious circle on women under-representation in science. The same report concludes to a number of measures that should be taken towards equality, and thus quality, in the research arena. These include the following: a sincere commitment by national governments towards equality and mandatory gender balance in decision-making bodies; transparency and meritocracy should be enhanced; decision-makers, peers and the public should be regularly updated and educated about the inequality issue and how to address it.

In conclusion, action must be taken. A good friend of mine, Adamantios Koumpis, Research Director of ALTEC S.A., when presented with these facts and issues, commented that: “*Clemenceau said that ‘war is much too serious a matter to be entrusted to the military’ – in the same way, one could dare say that research is much too serious a matter to be entrusted only to the men*”...

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