Notes and References

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Women in Science, Engineering and Technology

Women in Science, Engineering and Technology Advisory Group, Office of the Chief Scientist, Department of the Prime Minister and Cabinet

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At the time of writing of this review, it is almost two years since the publication of the Advisory Group's report and some of the analysis, discussion and recommendations may well be a little out of date. For example, the changes wrought among scientists, engineers and technologists, their disciplines and their activities over the past few years by the so-called 'information revolution' continue unabated and include the rapid development of this revolution's own source—a branch of knowledge and application that combines the sciences of physics and mathematics with electronic engineering and technology. Having said that, the underlying issues still remain for women wishing to enter and to make their careers in science, engineering and technology (SET), and equity and justice are still in question. So, for its insights into them, and the ways proposed by the Group to deal with them, this publication has a good deal to say.

The main issues are that women continue to be underrepresented in some disciplines of SET, are seriously underrepresented at the most senior levels in all disciplines, have relatively poor retention rates on a career-long basis, and suffer degrees of gender bias and harassment from the male members of society. On the one hand, the report views the issues themselves as still being incompletely understood but, on the other, recent statistics indicate improvement in the participation of women in SET-based education, training and employment over the decade since the mid-1980s.

There is, the Group says, a 'need for a paradigm shift away from asking what is wrong with women to questioning what it is about the environment of SET (and society's perception of it) that it does not attract and retain the interest of girls and women'. The corollary, of course, is that this situation does not allow Australia to make the best use of its human resource potential.

Regarding the paradigm shift, the Group adopts two underlying principles: the need to question what it is about the environment of SET (and society's perception of it) that does not attract the interest of girls and women; and the need to adopt a holistic policy approach to the issues associated with their participation in SET. The Group recognizes that such requirements affect the education and careers of *all* women. In developing recommendations, it recognizes the wisdom of making use of the existing mandates of government departments, programmes and budgetary expenditures in addition to devising new ones, and the difficulty of framing recommendations for action by the private sector. At the same time, it recognizes that the SET disciplines are not homogeneous and the issues surrounding them complex, and that responses from the subdisciplines will not necessarily be similar.

Formed in May 1993 by Senator Schacht, then the Minister assisting the Prime Minister for Science and the Minister for Science and Small Business, the WISET Advisory Group was asked specifically to advise him on strategies to improve the participation of women in SET education, training and employment and, in particular, to address issues related to: improving the participation of women in senior SET positions in both the public and private sectors; improving the level of participation and retention by women in SET education and training at the vocational and academic levels; and improving awareness of the contributions women make to science, engineering and technology in Australia.

In addition to its own analysis and discussions, the Group invited some 300 individuals, associations and organizations to comment on the underlying issues and on its recommendations—focused on areas most likely to generate change—in a three-step implementation process that would take into account the discussion under the three-part terms of reference just mentioned. Some 95 submissions were received. The consensus apparently was that the recommendations could be effective, but stress was put on the need for patience and adequate funding and on the problem of effecting change in the private sector. Some of the submissions called for indicators for the success (or failure) of the measures. These, presumably, are politically and socially preferable to having *targets* for 'x' years into the future for education, training and employment in SET as a whole, in the three main disciplines, or in their various subdisciplines.

It is worth noting, almost parenthetically, that the submissions came mainly from the academic community, with some government but little professional or industrial participation. The academic community also supplied the majority of the members of the Advisory Group. The difficulties involved in getting input from the industry sector are well known and have been recognized by the Group as a situation that places the data searcher—knowing that the majority of engineers and technologists, at least, are employed by this sector—on the horns of a dilemma.

From the statistics given in the report and the Group's discussion and analysis, it is evident that the principal SET difficulties lie within 'E'—engineering along with building, architecture and surveying. While women do not participate equally well in all of the subdisciplines of 'S' and 'T', their participation rates are apparently better. But retention rates and promotions into the upper levels of responsibility tend to decrease—often rapidly—with age and seniority throughout SET. The solutions therefore lie in two main directions: getting more women into engineering in the first place; and providing an overall environment that encourages retention—and promotion.

In the concluding section of its report, the Advisory Group divides the implementation schedule for the recommendations made earlier in relation to its terms of reference among the short (over the next 12 months), medium (1–3 years) and long-term (3–5 years) strategies. Under this schedule, the short-term ones, and most of the medium-term ones, that have been accepted should be under way by now.

Among those on a short-term 'leash' are: the establishment for at least a four-year trial period of a Women in Science, Engineering and Technology Unit (WISETU) within the IST Ministry's Science and Technology Awareness Program to initiate, develop and monitor policies for advancing women in SET education, training and employment; expanded awareness-raising programmes aimed at employers, unions and education

sectors, dealing with behaviour problems that limit women's access to SET-based education, training and employment; improvements to the statistical base, including the disaggregation of SET statistics by subdisciplines; the study of the policy implications of the inter-institutional variations in the enrolment of women; and the study of factors affecting discipline and subdiscipline participation.

Recommendations to be implemented in the medium term include: provision of funding for re-entry scholarships, particularly at the postgraduate level; provision of funding for flexible top-up and bridging courses in SET for women returning to employment and wishing to renew/update their knowledge bases; the documenting of the extent of mentoring schemes for women and the development of best practice guidelines for them; encouragement of the recognition by selection panels of prior learning in nonconventional subject areas by women candidates for senior employment; and the use of educational profiles to encourage education institutions to examine the underlying causes of lower levels of female participation.

Generally, the long-term strategies require more research and examination before they can be implemented. The improvement of the working environment for women is, according to the Advisory Group, a long-term process that involves such difficult questions as changes in the attitudes and expectations of employers and of both male and female employees. The recommended measures include: continuation of public sectorspecific reform and government actions to influence changes in union and employer attitudes to issues that particularly affect women; expansion of the number of programmes in female SET employment-specific priority areas, and perhaps also in the government's contract procedures; expansion of the documentation and discussion of gender equity and curriculum reform in the education sector as a whole; the implementation of properly funded bridging and other similar courses; assessment of gender-inclusive teaching staff development; and the funding of research and dissemination of curricula support materials.

In the report, the Group comments that some of the submissions it received call for long-term strategy measures to be implemented sooner. There is some merit in this. Other submissions recommend the use of targets for monitoring implementation. This also has merit—providing that such targets are disaggregated to take account of the different subdisciplines of SET and the differing employment opportunities in each of them.

From this reviewer's viewpoint, whatever the timescale decided upon for the implementation of the Group's recommendations, it is the 'E' discipline that is clearly in need of priority attention. But in dealing with engineering, it will be important to take into account a number of factors of special relevance that are not discussed by the Advisory Group. For example, all three SET groups include people—for example, atmospheric physicists, civil engineers and biotechnologists—with different mindsets, talents, interests and outlooks. Indeed, within engineering itself, one might say that the most common link between civil and mechanical engineers nowadays is that both need to use computers!

Those who 'engineer' are mostly practitioners, while those who 'do science' are mostly researchers and teachers. Practicing engineers also have more direct links to the public and, consequently, must build public safety into what they do. This puts additional emphasis on competence and experience as components of selection for both senior and junior positions. Also, engineers' career patterns often involve technical practice during the early years and management during the later ones. This brings in the need to examine the problem of the so-called 'glass ceiling' that may affect the promotion of women to the top ranks of management in almost every sphere of engineering activity. Technologists tend to be associated more with practice than research and should be studied in much the same way as engineers.

To this reviewer at least, the comments in the report about the exclusion of women from computers and computing are somewhat surprising in the light of his experience. The access situation in Australia may indeed have improved since the report was written although, on the other side of the coin, the information 'revolution' is continually changing the ways in which science, engineering and technology are 'done'—and not always for the better as far as the numbers of those employed are concerned. This issue needs re-examination.

The Advisory Group recognizes that there are education, training and employment issues that affect all women, and discusses these 'generic' ones in its report. This serves to underline the holistic policy approach it has taken to the main issues and recommendations. The report does not, however, discuss the reasons why the medical, legal and accounting professions have—over the last two decades—been successful in attracting significantly increased numbers of women practitioners and researchers. Nor does it discuss role models or success stories within SET.

Lastly, just a few words about equity and justice. The thrust of the Advisory Group's report is in these directions and, although the Group's recommendations are designed to advance both, they remain under-examinated by the end of it. But both, as concepts, are seen very much in the eyes of the individual beholders who will—in the last analysis—make the decisions.

I hope the new Minister has established the recommended WISET Unit and put it to work.

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The Environmental Imperative: Eco-social Concerns for Australian Agriculture

Frank Vanclay & Geoffrey Lawrence

Rockhampton, Australia, Central Queensland University Press, 1995, xxvi + 203 pp., AU\$19.95 ISBN 1 8759 9800 4

'The environment has suffered more neglect at the hands of social scientists than any comparable subject' claimed Michael Redclift. With this claim being highly admissible, it is to be celebrated that *The Environmental Imperative* is a move towards the expansion of the sociologist's task, while also adding timely input and advice to the debates surrounding the nebulous topic of sustainable land use in Australia.

The authors open by claiming that 'Australian agriculture, in the mid-1990s, remains in crisis ... [while] Current thinking appears inadequate to the task of understanding the real nature of environmental problems within Australian agriculture' (p. ix). Vanclay and Lawrence have offered not only a critique of such thinking, but also have pointed to the ways in which their own discipline of sociology may play crucial future roles in reshaping both thinking and practice involved in the agricultural and scientific research industries. Readers take note: this text is far from singly applicable to sociologically minded scholars but reaches out to challenge the range of researchers, policy makers, bureaucrats and teachers whose fields transect in one way or another agricultural activities in Australia.

The authors bring together a formidable range of experience in the realm of