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Diversity training for engineers: making 'gender' relevant

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In 1992, at the UN International Conference on Water and the Environment in Dublin, delegates adopted the principle that 'women play a central part in the provision, management and safeguarding of water'. While this principle has been largely accepted at policy level in international development, it has proved harder to put into practice. Gender training for engineers and allied professionals was treated as a socioeconomic issue and not part of mainstream infrastructure and basic public service provision. As part of a 3-year study into this area and a series of subsequent training courses, a team of engineers and training professionals has developed new conceptual approaches to training engineers, focusing on the practical application of the Dublin principle. The study looks at the concepts of relevance, engagement and practical skills required to deliver infrastructure services to the whole of society.

1. Introduction

The 'international drinking water supply and sanitation decade' (1981–1990) resulted in the recognition that women in low-income countries play a pivotal role in the safe collection, transport, storage and use of the household's water. Women maintain and clean latrines and motivate personal hygiene practices. They carry the burden of their family's health – particularly that of young children, which is inextricably linked to water and sanitation. It also underscored the importance of 'community' engagement so that facilities provided are wanted. This was supported by an extensive study by Narayan (1995) demonstrating a positive correlation between successful water project outcomes and the involvement of women. This position was institutionalised in the adoption of the Dublin principles in 1992 at the International Conference on Water and the Environment, which preceded the United Nations Rio Conference on Environment and Development. The third principle states

Women play a central part in the provision, management and safeguarding of water. This pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of this principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them. (ICWE, 1992)

Subsequently gender was incorporated in many non-governmental organisation (NGO) and government policies (Reed

and Coates, 2002) and was mainstreamed in aid strategies. In the Department for International Development's (DFID) target strategy paper, 'Addressing the water crisis: healthier and more productive lives for poor people' (DFID, 2001), people, communities, civil society groups and women were placed at the centre of service provision, although the paper recognised this was only occurring in an ad hoc manner.

Around the world, there are many examples of successful community management. It has mainly been demonstrated in rural areas, and on a small scale. Two major needs therefore exist: to scale up demand-responsive and community management approaches into national policies and programmes in countries where pilot projects have been successful; and to assimilate the lessons and pilot these approaches elsewhere. These may involve significant changes in the way the existing water sector institutions work. In recent years, women have become more involved in these processes. Experience showed that community-based management achieved more when women's voices were heard and responded to. More broadly, a range of social, economic and political issues can inhibit participation by both women and men, so water agencies have to understand and deal with these wider development issues, not only with technical subjects. As to the professional staff in the sector, the large majority of water policy-makers and practitioners in most countries are men. (DFID, 2001)

This paper describes an action-research project to develop training materials to mainstream 'gender' in engineering. The initial pilot project indicated that substantial revision was required; the process had to be substantially changed by revisiting basic principles of civil engineering.

2. The initial project

Staff at the Water, Engineering and Development Centre at Loughborough University carried out a 3-year DFID-funded knowledge and research project that set out to 'Build on existing materials to provide and disseminate well focused practical tools to enable engineers and managers to incorporate gender issues effectively into the project cycle for water and sanitation and other infrastructural works.' Although the subject focus here is water and sanitation in low-income countries, the learning has wider implications for the training of other sector-specific engineers in both industrialised and low-income nations.

Despite the evidence and official policies, observations and anecdotal reports showed that women's views are still not sufficiently influencing the technical design aspects of water and sanitation services. Responses to the recognition of the important role of women in development has evolved positively over the years, with projects aimed specifically at women (women in development) becoming projects involving women (women and development) and finally looking at the wider gender issues with 'gender and development'. The next stage of evolution was 'mainstreaming' gender, in which the needs of women were incorporated into the main project delivery process (Derbyshire, 2002). However, experience showed these still fail to integrate with technical engineering and infrastructure development and therefore 'miss' the engineer. A common indicator of gender mainstreaming was to ensure the presence of women on any management board, rather than any change in the practical provision of infrastructure.

2.1 Project process

As the subject matter had been written about extensively (e.g. see GWA, 2012), it was felt that primary research was not required. The literature wholly supported pro-actively meeting the needs of women in water and sanitation projects (Fisher, 2008), providing evidence that engineering products do not always address the needs of women. A team of men and women, engineers and social scientists collated a series of case studies on women and water issues, and drafted a 2-day training course and guidance manual for piloting in South Africa and India, using the case studies as practical, relevant examples of the problems women face with water and sanitation provision.

2.2 Piloting the material

2.2.1 Training courses

The first participative 'gender' workshops included basic gender analysis and gender roles, stakeholder involvement, gender mainstreaming, practical and strategic considerations, human rights and the application of gender issues in water and

sanitation projects. On delivery, however, the outcomes of the course proved fundamentally flawed. Although the target audience was engineers, those actually attending were social scientists and community workers, afforded the opportunity for training by their colleagues because engineers saw them as being 'responsible for' gender issues. Interestingly, this also happened in a series of NGO training courses in Afghanistan when engineers attended the technical engineering sessions (boreholes, wells, drilling) but a different set of participants attended the gender workshop.

A second pilot course in India had more success in securing engineer attendance but only because it was piggy-backed onto an initiative already aimed at them. This second pilot was shorter and not as rigidly structured, allowing for deeper engagement with the participants.

2.2.2 Feedback

From the discussions with the Indian participants, several clear messages emerged including problems with the very word 'gender'. This was especially important when translating material and facilitation into other languages, leading to confusion about the different connotations between 'sex' and 'gender'. Replacing it with 'community', 'society' or even 'people' undermined the gender component. The phrase 'women and men' was tried but seemed forced and distracted from the writing style. Eventually the phrase 'men and women' was adopted.

The case studies also failed to get the desired response, emphasising 'bad practice' rather than the good practical ideas that make engineering products a success. This necessitated less emphasis on 'why gender?' and more on what engineers can do as part of their job.

The Indian engineers also criticised the appearance of the draft of the guidance manual – the main output of the research, seeing it as a 'story book'; a narrative with illustrations focusing on social rather than technical issues. Engineers could not imagine the manual on their shelves at work (see Figure 1).

Unexpectedly, the debate extended into engineering offices. Female engineers said that their professional and gender perspective was not adequately used because (in India) it was difficult for them to undertake site work due to social and cultural constraints placed upon them by those in and outside work. Exclusion was thus seen as a barrier to promotion for women engineers and a problem in project delivery, as consulting with women in rural villages was deemed easier if carried out by a female engineer rather than either a male engineer or female social scientist with no engineering experience.

Figure 1. Illustration from draft guidance manual (unpublished).
Source: WEDC. ©Marianne Hellwig John

3. Responding to feedback

A radical rethink was needed. In order to get engineers engaged in the topic in the first place, the material would have to 'shout engineering' to get engineers to attend any gender course or open any guidance manual and then engage with the technical mindset of engineers. The initial drafts had proved useless, falling into the trap of looking at the subject – gender – from the perspective of a social scientist, rather than the engineer. This orthodox approach meant 'gender' as a subject matter was persistently threatening the problem-solving performance of engineers who supposedly provide technical solutions for all people.

The challenge of successful writing became one of allowing the reader to connect to the subject in their own world, whatever their (and the authors') existing views, biases and prejudices. This gap between the learner's current level of awareness and what they can satisfactorily learn is called the 'zone of proximal development' by the Soviet psychologist Lev Vygotsky (1896–1934). The gender literature had proved to be lacking in engineering perspectives and so new primary action-oriented research was required.

3.1 Revisiting fundamentals

The revised methodology consisted of two strands. A second literature review focused solely on engineering texts. This was coupled with a series of focus groups, workshops and training courses with engineers. These were often opportunistic, using existing courses or conferences for engineering staff as a method of engaging with the target audience (see Table 1). The two authors worked as a pair, one trialling various training methods and the other observing the participants and evaluating the workshop.

3.1.1 The engineering literature

Although considerable literature existed about 'gender and water', it was written from a development studies or social science perspective and lacked practical guidance on the design of women-friendly infrastructure. In the core 'engineering' literature, social issues were largely lacking. Reviewing works such as *Civil Engineering Procedure* (ICE, 1996) or *Water Supply* (Twort *et al.*, 2000) revealed that a user perspective of any sort was generally lacking in standard (water) engineering textbooks. Even appropriate development infrastructure books lacked specific guidance on the design of sanitation facilities for women (e.g. Franceys *et al.*, 1992).

3.1.2 Talking to engineers

Focus group work with humanitarian and development engineers confirmed the problem with 'gender' as a word and definition. When asked whether beneficiaries were treated as a homogeneous group or a segmented population (suggesting different needs, and therefore solutions) the picture was mixed, with standard solutions being implemented as the norm and few examples of adaptations to meet cultural and political requirements. 'A refugee is a refugee' was one comment, despite acknowledgement that the majority of refugees and internally displaced people are women and children.

The understanding of the word 'gender' was not clear, with problems of translation being an important point. Seen as a 'fad', or even worse as 'imposed political correctness', it was consigned to policies and funding proposals with little practical application, although sometimes synonymous with 'vulnerable'. However, there was strong recognition of the specific social roles of women in water and sanitation, their lower status in society and vulnerability to harassment, attack and rape when collecting water from remote sources or using isolated latrines late at night. Their particular physical needs related to water and sanitation infrastructure (such as privacy during menstruation and the need for water to rinse bloody cloths, or soap and water for hand washing) were less well understood. Specific 'gender' actions were seen as less of a priority in an emergency than basic services such as food, water, sanitation and healthcare.

Method/location	Participants	Numbers
Focus group (UK)	International humanitarian organisation. Technical staff	15
Workshop (Zambia)	Water Aid and associated staff	12
Pilot training course (UK)	UNICEF staff from Nigeria	14
Pilot training course (India)	National water NGO staff – technical	≈20
Pilot training course (South Africa)	National water NGO staff – non-technical	≈20
Training materials review (UK based)	National water NGO staff. Afghanistan	≈30
Interviews	UK-based engineers	6
Conference workshop (Dhaka)	International water and sanitation professionals (various levels and backgrounds)	≈40
Conference workshop (Lusaka)	International water and sanitation professionals (various levels and backgrounds)	≈40
Conference discussion (UK)	International water and sanitation humanitarian professionals	≈50

NGO = non-governmental organisation

Table 1. Workshops and pilot training courses

Discussion of how the organisation and employees respond to gender (in this case an international humanitarian NGO), exposed a bias towards men playing technical roles, especially with locally recruited staff, even though the overall gender balance within the organisation was less extreme, with 30–40% of staff being women. The problems of women entering the engineering profession are well known (Faulkner, 2006), but their specific role in being able to consult with female members of the community on technical issues is not always recognised.

3.1.3 Testing motivation

Understanding the motivation for changing behaviour is a current area of research in the water, sanitation and hygiene sector. For example, people are not motivated to wash their hands with soap simply because it prevents diarrhoea. To inculcate behaviour change the practitioner needs to understand a complex mix of social status, images of beauty and practical support that trigger more people to practise the behaviour than not. This principle of understanding what motivates behaviour change was applied to this project.

The original material had a strong rights-based approach to gender; women have a basic right to be consulted ('don't do anything about me, without me'). This approach was supported in turn by adherence to policies and practices (as most development and humanitarian organisations had gender discrimination policies even if engineers were not aware of them (Reed and Coates, 2002)) and, only finally, the water supply project may be improved if women are involved. The impact of this rights-based approach was trialled with a group of Nigerian water utility managers attending a management course. One trainer introduced a discussion looking at the

vulnerability of women, their relatively weak position in society and other social perspectives on gender. The debate (seven men and seven women) became divided along gender lines and a heated exchange ensued. The two authors then swapped roles and proposed a different way of looking at the issues, focusing on equity in access to physical infrastructure rather than the social position of different groups in the community. The discussion looked at the possibility of providing water and sanitation infrastructure in a manner that met all users' needs, as men and some women may have different needs, such as men can stand up to urinate and women do not. This position was unifying and focused on the main role of engineers as providers of physical services rather than the more controversial aspects of social engineering. This trial also showed the preference for practical, physical solutions.

Adopting this approach removed the frustrations of trying to translate human rights and gender issues meaningfully (which requires long-term, sustainable societal change) in the context of short, intense engineering projects in which the focus is the delivery of infrastructure services resulting in a solution that is equitable to the needs of men and women without harming either group.

The original rationale for involving women was rights, policies and pragmatism in that order. The order was then reversed, with practical reasons for involving women placed first. Engineers are motivated to produce a product on time and in budget to the satisfaction of the client. Involving women in the design and construction process could be demonstrated to make this easier as women are often more aware of water and sanitation issues locally, as it is their role to manage these aspects of domestic life. Therefore – for example, spring-yields in the wet and dry season are closely monitored by the people

who collect water and these are mostly women. This idea could be extended from women being suppliers of information to playing a more active design role. Drawing on *Civil Engineering Procedure* (ICE, 1996), there is opportunity to discuss who the 'client' is in public infrastructure projects. Various groups can be identified, with the funder (perhaps a government, NGO or local authority) often being separate from the user. The social science language of 'beneficiary', 'stakeholder', 'actor' and 'vulnerable group' does not carry the same weight with engineers as the concept of the 'client'. Calling the 'user' the 'client' moves the role of women from being the passive beneficiary of the largesse of a donor to an important decision-maker. Delivering water supplies that are not used as they do not meet the needs of all users is a failure of the project and would not contribute to the wider rationale for funding water supplies, such as improved health. As an example, it is estimated that an equity-focused strategy based on a US\$1 million investment in reducing deaths in children under 5 years in a low-income, high-mortality country would avert an estimated 60% more deaths than current approaches (Lancet Editorial, 2010).

The other motives for involving women were still important; the existence of policies was not viewed as a 'this must be done' directive, but giving permission to the engineer to engage with women in the decision-making process. The donor, funder or agency commissioning the project may still feel that they are the client, but policies give the engineer the freedom to consult with the user. Rights are important, but engineers only need to be aware of them, as in the short duration of an infrastructure project engineers are not going to be able to bring about lasting social change. How they act during the project, however, may give a message to the community that women's views are worth listening to and begin the slow challenge to existing social exclusion.

4. Revising the training

Following the series of workshops and discussions, the material for introducing gender to engineers took several major steps away from the previous approach. While the delivery of a 2-day training course on 'gender' to engineers was seen as standard practice in many development organisations, it was obviously not having the intended impact, regardless of quality.

4.1 Small steps in the right direction

4.1.1 Practical content

'Gender' can be seen as a socially constructed concept and literature reviewed frequently came up with socioeconomic responses to the gender and water issue. For example, it was widely recommended that any water management committee had two women on it. This was a good example of a socioeconomic response to a socioeconomic problem, but one

that did not necessarily result in any physical change to the design of the infrastructure, as the social scientist leading the process was not familiar with the technical options available. This limited perspective had been observed in other contexts

...very few gender experts have experience or training in management or organizational development in the traditional sense.... This means [gender experts] may not have the tools to address the problem which will necessarily be understood or accepted by those who are part of the problem. (MacDonald *et al.*, 1997)

One senior engineer consulted during the project dismissed the need for gender aspects of water projects, but when asked if he could make a latrine slab that was easy to clean, he replied that he could – but that nobody had ever asked him to. One of his colleagues objected to infrastructure funds being 'wasted' on activities that did not directly improve women's lives, as she viewed pipes more useful to women than participation.

To ensure that the training was seen as relevant, the material centred on engineering solutions to socioeconomic problems. Women are often responsible for cleaning the toilet, so provide smooth concrete finishes to pit-latrine slabs to make this chore easier. Women have to collect water, so they may have opinions about the location of the hand pump, as water collection provides opportunities for social interaction and the need to do their laundry nearby should be considered alongside hydrogeological factors. Women may have less access to vehicular transport, so roads should include proper provision for pedestrians. These are all actions that require engineering input but that have social benefits for the user. The aim was for engineers to deliver services to the whole community, not engineers who could talk about gender but still not meet women's infrastructure needs.

4.1.2 Practical language

The original material was written using a social science vocabulary. Apart from 'gender', there were other areas of confusion between engineers and social scientists, such as 'demand'. A 'demand-led' project is one that (theoretically) meets the needs of the user rather than the wishes of the supplier of the infrastructure. Water engineers, however, may consider 'demand' to be the amount of water required and supply has to meet demand. 'Process' can be the way a project is carried out (such as demand-led or supply-led) but it can also be a 'treatment process'. A glossary was considered, but research with the university's English department revealed that the reader will only engage if the subject is of relevance to them and that the words are not the only barrier to communication (Christie *et al.* 'Did I phrase that correctly? Making sure your technical terminology isn't someone else's jargon.' Unpublished interim research report for DFID. WEDC, Loughborough University,

UK, 2004). This coincided with the comments from the Indian engineers that the guidance manual did not look like an engineering text. The figures were changed to show practical engineering solutions so the publication had an engineering appearance. Figure 2 shows a practical solution to ensuring drop-holes are covered to exclude snakes and flies.

One significant phrase that did need defining, however, was not 'gender' but 'civil engineering'. It was felt that civil engineers needed to know that meeting the needs of their 'client' and wider society was a core aspect of civil engineering and not something added on or addressed by others. Thomas Tredgold's 1828 definition of 'Engineering is the art of directing the great sources of power in nature for the use and convenience of man' was used as a basis for discussion. Engineers were very content with the 'science' aspect contained in the first part of the phrase, but the 'society' aspect is often neglected. Redefining the success of a project from simple delivery of a physical product to a wider appreciation of the social, economic and environmental impacts (positive and negative) of infrastructure development is essential if civil engineering is to be relevant.

4.1.3 Practical delivery

The experience from the early trials suggested that engineers would not willingly attend a whole course on 'gender'. Barriers must be overcome to demonstrate that 'gender' was a valid engineering issue. The authors decided to build on a typical engineer's day, building opportunities for gender training (without use of the term) into site visits, design consultations, project meetings or short lunchtime sessions as well as forming a longer training workshop if required. Raising awareness and providing practical examples of relevant engineering actions were prioritised over debates about what gender is and instructing people why it is important.

The training courses were still planned to be participative, but rather than being group discussions led by an experienced facilitator, it was more directed so that it could be carried out at opportunistic moments by project managers, team leaders or other interested engineers. It was realised that, in order to consult with women, engineers needed to be aware of the various participative techniques that have been developed to promote dialogue with community groups. Rather than teach these techniques in an abstract manner, tools such as community mapping, stakeholder analysis and running community meetings were themselves used as training techniques. To place these in context, they were compared with standard engineering survey methods and design tools.

Not only were physical solutions to 'gender' problems used to engage the engineering audience, the training sessions were also active. Problem-based learning, 'learning by doing' or active experimentation approaches to teaching are often considered as being preferred by engineering students, rather than more reflective and theoretical approaches. As an example, a simple, practical design exercise was developed to demonstrate the need to take people into account in the design process. The task was to design a squat plate for a pit latrine, by simply determining where the footrests should be (Figure 3). The tallest and shortest people were asked to squat over a large sheet of paper with a 'hole' drawn on the paper, and the position of the feet recorded. This was then repeated with an engineer role-playing a person using a pair of crutches or walking stick and finally a male engineer with a cushion strapped to his stomach to mimic pregnancy. This exercise engenders lots of debate about the physical design of the latrine, as issues such as the size of the cubicle, the need for handrails and the smoothness of the slab are all discussed. However, the exercise also prompts debate on the problems of discussing such issues in public, especially if you are not

Figure 2. Illustration from final guidance manual: a simple technique for preventing snakes from entering the pit. Source: WEDC

Figure 3. A pit latrine slab showing footrests. Source: Mike Smith, WEDC

used to speaking out. This allows the concept of social exclusion to be linked with the need for appropriate physical designs.

Many engineering concepts, such as mathematics, are taught using a linear, logical progression from an axiom or towards a goal (Overton, 2003). This pattern was used to demonstrate the steps to a successful project, so, for example, the ultimate aim of infrastructure services is to increase wealth, health and the quality of life; this will only occur if the physical infrastructure is used to its full potential. For this to occur, the service must meet the users' needs, which requires those needs to be clearly defined. To find out what the users require, they need to be consulted and there are many (participative) techniques to discover user preferences. Representatives of all users need to be consulted; just as rock types vary from place to place, so do societies, therefore site surveys need to look at community aspects as well as physical conditions. Some parts of the community are harder to engage with, so the surveyor has to make more of an effort, by ensuring that consultations occur at a time, place and manner that is convenient for the user/client.

4.2 Beyond gender to diversity

It was found that variations in physical ability (such as constraints due to pregnancy and standing to urinate) were easier to comprehend (as they can be experienced to some extent) and respond to with physical infrastructure than social exclusion. This led the team to widen the training to include other physical dimensions of vulnerability such as disability and age as a way of introducing the concepts. However, the social restrictions that disability or age also entail are easy to communicate. Most people will have experienced being too old/young, too rich/poor or perhaps the wrong race, nationality or religion to do something. By relating to these

experiences, people can have some empathy with other forms of social exclusion, such as being the 'wrong' sex. Using a logical approach, an engineer could start with the most common and widespread indicators of social exclusion, namely gender and economic status, before examining other possible factors, rather than considering gender as being more important than other factors. This reflected the outcome of the focus group, in which the NGO workers considered a wide view of vulnerability important rather than just gender.

4.3 Testing the new material

A half-day workshop was held with national staff of an international NGO in Zambia. They were not informed that it was a 'gender' workshop as it was added on to the end of another training course. Various activities were tried, including defining civil engineering and an interesting task looking at the design specification of a simple pit latrine from the perspectives of different stakeholders, such as hydrogeologists, health workers, construction staff and a woman with a baby.

In the debriefing session afterwards, the participants were surprised to find that they had been in a 'gender' workshop. They had had several years' experience of working in community water supply and had assumed they knew all about gender, but they realised that they were still using a 20-year-old standard latrine design that did not take into account any of the users' needs. In the training session they had assessed the widely accepted, ventilated, improved pit latrine and demonstrated that it was not user friendly. In none of their previous gender training had changing infrastructure to meet user needs been discussed.

5. Conclusions

As an action research project, the final training material evolved from a series of workshops. Evaluating its impact since is difficult as the material is now fully integrated into technical courses run by the authors. Raised general awareness is more difficult to assess than confirming if an engineer can define 'gender' or quote policy documents. However, an NGO manager in Uganda described a former student as 'that XXXX really understands gender', indicating that his fleeting experience of 'pregnancy' in an engineering class seems to have had a lasting impression. There are, however, some more concrete conclusions that can be drawn.

5.1 Defining 'civil engineering'

At the heart of the final training course was a re-evaluation of what civil engineering is. Tredgold's definition is a good trigger for discussing what – or rather who – is civil engineering for. A civil engineering project that does not meet the needs of society is a failure, even if the hydraulic or structural calculations are correct. The 'science' part of engineering is often out of balance with the 'society' part

If medical schools trained physicians the way engineering schools train engineers, they might start with a definition of medicine as the application of drugs and knives to the human body. They would then proceed to teach students everything about drugs and knives and throw in a few superficial courses on the human body. These biology courses would be elective, and they would be orientated primarily toward improving the doctor's ability to handle himself at cocktail parties, rather than toward improving his ability to practise his profession. Medicine is not taught that way. Engineering should not be taught that way either. A well-trained engineer needs a sound knowledge of his patient – society.

(Simon Ramo, cited in Salvadori, 1977, quoted in Hamdi, 1996)

The lack of positive examples of infrastructure designed to meet particular needs was noted. Cars are designed for all shapes of people – and a wide range of budgets. Water and sanitation infrastructure in low-income countries has followed a one-size-fits-all pattern in the past, but new initiatives such as community-led total sanitation and rural water self-supply are beginning to widen the choice of options available.

5.2 Design process and product design

One recurrent theme is that in order to change the engineering product, so that it is better suited to the user, the design process has to change. How something is designed influences what is designed. Consultation needs to be integrated much more overtly into the engineering procedure. A structural engineer would not design foundations without a site investigation, but an assessment of the state of the community they are providing with infrastructure services is not considered part of the core process. However, part of the problem is that there are no tools for assessing the physical infrastructure needs and preferences of the community; many of the participative tools developed focus on socioeconomic information rather than determining technical specifications.

5.2.1 Engineering for social scientists

Engineers need to work in partnership with social scientists to develop such tools. Just as an awareness of the role of women in the design and selection of infrastructure is important for the engineer, the social scientist needs to be aware of the life-changing potential of properly designed and constructed water supplies. However, this needs to be presented in a manner and format that is relevant to that particular audience. Mainstreaming gender may require social scientists to 'let go' of their monopoly on gender responses, but also for engineers to share their technical role more widely. This was one area in which the project failed to make much progress, as the use of engineering language, priorities and examples designed to appeal to engineers excluded the social scientists

in a reversal of the problems encountered during the pilot stage.

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