

**SWP 15/97 A QUALITATIVE STUDY OF THE RELATIONSHIP
BETWEEN GENDER AND MANAGERIAL
PERCEPTIONS OF ENGINEERS' COMMITMENT:
CASES FROM THE UK AND SWEDEN**

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ABSTRACT

With a global shortage of top engineers, high-tech organizations need to retain and develop key engineers, yet few women reach senior engineering management. The problem could be resolved by attracting and developing more women engineers. Men are often quoted as saying that women are not committed enough for senior management, but preliminary questioning in this study as to how male engineering managers know when someone is committed (whatever that may mean in this context) found that they say that they know "by gut feel", and find it difficult to verbalise what it is that they know or how they know it. There is evidence that those employees perceived to be more organizationally committed by their managers receive more career development than their peers. Organizational commitment can be broken into affective commitment and continuance commitment. Women are more likely to be rated as low on affective commitment, and high on continuance commitment, which is less valued as a characteristic for promotion. Building on a US quantitative study on managerially perceived commitment and career development rewards, a qualitative framework is presented to investigate whether men and women engineers and senior managers have different meanings of commitment, how they perceive commitment; and how they use those meanings and perceptions when allocating key developmental experiences to subordinate men and women engineers. Cases have been selected in the UK and Sweden, to reflect the wide range of availability of flexible working and childcare, often suggested as a panacea for women's lack of progress in the UK.

KEY WORDS: engineers, gender, commitment, UK, Sweden

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1. Introduction

As professional engineers grow by on-the-job training, job rotation and job challenge as well as by formal training (Lam, 1996; Lee & Smith, 1992; Davies & Easterby-Smith, 1984), gradually acquiring a portfolio of key experiences for later top positions, it is important that women engineers gain equal access to opportunities for such development. Very few women engineers are breaking through the so called "glass ceiling", an "apparent barrier to advancement to the highest level of an organization" according to Morrison, White & Van Velsor (1987), and research on women managers' careers by Ohlott, Ruderman & McCauley (1994) has indicated that women may not get equal opportunities for on-the-job development and job challenge.

Whilst women engineers' competence may be assessed by qualifications, experience and performance, the assessment of their commitment by their mostly male managers may be influenced by the attitudes and socialisation experiences of the assessors, and by the organizational culture and structure within which the assessment takes place (Schein et al, 1996). So what does it mean when male managers say that women employees are not committed enough, and do they mean commitment with the same meaning as the psychological construct of organizational commitment? From preliminary interviews in this study, engineering managers say that they know "by gut feel" as to whether someone is committed, but they find it difficult to express how they know. The most usual instrument to measure employees' commitment is the well-validated self-report questionnaire developed by Mowday, Steers & Porter (1979). This has been used for over a quarter of a century, during which period women have entered and stayed in the full-time workforce in ever greater numbers, with greater career ambition, as societal norms have changed. Would such a measure of commitment answer the question as to why some male managers perceive women to be less committed? Only very small

differences have been found in levels of self-reported organizational commitment between men and women (Mathieu & Zajac, 1990), so this is unlikely to give the answer. We need to know what male managers mean by commitment, since their answers may indicate how they perceive women to be committed differently to men, which in turn may impact the allocation of key developmental experiences differently for women and men.

This paper proposes a framework for a qualitative study of male and female engineers, focusing on the impact of their meanings and perceptions of commitment on subordinates' career development opportunities in an important industry (aerospace/power) where there is a global shortage of well-qualified engineers, and few females in senior positions to encourage more women to enter and stay in engineering. The products have a long development cycle requiring enormous financial investment. With such long-term risks involved, organizations need to recruit, retain and develop their future top engineers over a very long period, but there is a shrinking pool of top talent. It may be possible to attract more high quality women into this profession if those who have already chosen it are able to succeed at an equal pace to the men.

After a brief consideration of the problems of female stereotyping where commitment is concerned, the concept of organizational commitment and its components of affective and continuance commitment are reviewed, followed by an examination of research on managerially perceived commitment, and commitment in relation to professional women. An outline model of the commitment manifestation and outcome process is introduced, with a research framework to ascertain what commitment means to men and women engineers and their senior managers, whether high-potential women engineers are perceived to be as committed as their male peers, and whether they are given the same level of opportunities to build their career experience portfolios as high-potential men. The paper concludes with an overview of the implications for practice from the results of the study.

2. Perceived Commitment and Female Stereotyping

Kvande & Rasmussen (1991) report that women engineers are more likely to be seen as women first, and as engineers second. Similarly, Schein et al (1996) in

her “Think Manager, think Male” study reports that managers are still thought of as male, almost by nature. Griffiths (1985) reported that “females in engineering companies are allowed two roles: sexual object and domestic/office support”. This leads to the situation where women cannot escape being defined as women, with all the traditional female stereotyping, rather than as professional engineers, whilst they are trying to establish their commitment to the organization and to their careers in the same way as their male colleagues, for whom such commitment is assumed, is the norm, and seldom questioned.

Stereotyping by society influences women engineers as well as their male peers. The individual woman and her career are strongly influenced by her own personal characteristics, background, and potential, and these have been shaped by societal influences such as education and socialisation experiences, especially gendered role expectations (Kvande & Rasmussen, 1991). These influences affect the woman engineer throughout her working life. Her organizational interaction with the male gendered career system is impacted by market forces (women engineers get access to higher level jobs when there is a market need, as happened in Sweden during the 2nd World War [Berner, 1992]). Technological changes, such as computer modelling and robotics, have an impact on the organizational structure of work and the workplace for women engineers. Career systems are influenced by the organization culture, heavily male-dominated in engineering; and by the organizational structure, for instance, formal communications and the openness of the mechanisms for filling senior positions. Male managerial perceptions of women’s commitment may be used when opportunities for career development are allocated, and these perceptions based on male norms may result in women being given fewer chances for development than their male peers.

3. The Importance of addressing Engineers' Needs for Career Development

Women managers are likely to be given less developmental job experiences than men (Ohlott, Ruderman & McCauley, 1994). The mostly US-based organizational commitment research literature indicates that women are more likely to be perceived to be less committed than men, because of residual stereotypical attitudes towards women in society, and that people with perceived lower commitment will not be offered as much career development (Shore, Barksdale &

Shore, 1995; Allen, Russell & Rush, 1994). High-tech engineers need continuous developmental experiences, not just from formal training but just as importantly, from on-the-job development, job challenge and job rotation (Igbaria & Siegel, 1992; Lam, 1996). It would help organizations if they could attract and retain high-potential women engineers, as the talent pool shrinks, partly due to demographic trends, but partly in the UK due to the better rewards of other professions such as financial management consultancy which attract large numbers of top engineering graduates. This study is concerned with high-potential women and men graduate engineers in the aerospace and power industries.

As well as being more likely to get less challenging projects than men, high career potential women managers are sometimes given high visibility posts (which provides the important role models for younger women) but some of them feel like "corporate geishas", invited to important dinners with clients, sitting next to the guest of honour at corporate events, but often lacking the power associated with a male incumbent (Asplund, 1988, Kanter, 1977). Highly visible posts might also be a risk, as if they fail, the failure would be damning not just for them and their supervisors, but also for future women managers. Sometimes assumptions are made by managers that women would not desire certain kinds of challenges, made with the best of intentions to protect women from "difficult" postings, but not giving them even a chance to consider the advantages. Overall, women were less likely to be given the key assignments, which would enable them to build a career portfolio of relevant experience for future top-level positions, according to Ohlott et al (1994). Perceptions of their commitment are likely to have influenced this career pattern.

4. Definitions of Commitment

4.1 The Classic Definitions: Commitment is defined as "an obligation undertaken; declared attachment to a doctrine or cause" (Chambers English Dictionary, 1988). It is likely that the phrase "women are not committed enough" is being used as a rhetoric, which according to Parkin (1975), is a type of ritual which says something about the speaker, the spoken-to and the situation, and goes beyond what is contained in the surface message". Gowler & Legge (1981) say that rhetoric "legitimises actual or potential power and exchange relationships, eliminates

challenges to those relationships, and expresses contradictions in power and exchange relationships that cannot be openly admitted or resolved". The hidden male message behind the issue of women's lack of commitment to work may be that they feel that women should be at home caring for their children instead of aspiring to top jobs traditionally held by men. Initially, an assumption has been made for this research that the commitment referred to is likely to be holistic, and to relate mostly to organizational, but also to career and professional commitment.

The most commonly used definition of organizational commitment is that of Mowday, Steers & Porter (1979), as a concept encompassing the following:

- "embracing an employee's desire to remain in an organization,
- willingness to exert effort on its behalf,
- and belief in, and acceptance of the values and goals of the organization".

The first is called "continuance commitment" and the second and third are together called "affective commitment". Mowday et al (1982) called the process of commitment "the reciprocal influence of attitudes and behaviour". Since then, there has been much research on organizational commitment and its antecedents and correlates such as job involvement, job satisfaction, career commitment, professional commitment, organizational citizenship, central life orientation etc, some of which overlap so much that they should be redundant, according to Morrow (1983). Most of the measures of other work-related commitments simply use the same measures for organizational commitment, but substitute "career" or "profession" in the attitude statements.

Since the early 1980s, almost all the body of organizational commitment research has used only self-reported measures of organizational commitment, with most studies using the scale developed by Mowday et al, known as the OCQ, the Organizational Commitment Questionnaire, which measured affective and continuance commitment. There is another frequently used measure of the continuance element of organizational commitment, the costs involved in leaving an organization (Hrebiniak & Alutto, 1972), which is also called exchange, behavioural and calculative commitment. Meyer, Allen & Smith (1993) added another component, normative commitment, the obligation which employees feel to the organization, which makes them conform, and which organizations can use to

control behaviour. Further work on commitment by Reichers (1985) suggested that employees may experience (at the same time and to different degrees) multiple organizational commitments (to the team, to the department, to the management, to the local division) as well as global commitment (to the whole organization). He comments that the organization “is for many employees an abstraction - an abstraction that is represented in reality by co-workers, superiors, subordinates, customers and other groups and individuals that collectively comprise the organization”.

4.2. Definitions of Organizational Commitment from Employees vs from Researchers:

A feature of the body of research on organizational commitment is that few researchers have asked people in organizations what they understand as commitment. It is nearly always the researchers' definitions, especially that of Mowday et al (1979), which have been operationalised and taken for granted later. The employee's own experience of commitment is important, according to Reichers (1985) and this theme is picked up again in Randall, Fedor & Longenecker (1990). They sought to explore how employees expressed commitment themselves, in their behaviours and actions, by asking them directly. The employees did have different definitions to those from the management research literature about how commitment was shown; in particular, the concern for quality, the sacrifice orientation, and willingness to share information. These important features are lost when commitment is measured using the OCQ, with its emphasis on continuance commitment, effort and acceptance of the organizational goals. These findings demonstrate that other approaches to investigating commitment are needed, and Randall et al recommend more qualitative research in this area of conceptualisation of organizational commitment. This paper is therefore arguing a case for a qualitative study of managers' meanings of commitment in engineering organizations where commitment and career development are important.

5. Gender and Commitment

5.1 Professional Women's Organizational Commitment: A meta-analysis of the commitment literature indicates that there is little difference in levels of overall organizational and occupational commitment between men and women (Mathieu &

Zajac, 1990). It was also found that women tended to have less commitment-enhancing jobs than males (Marsden et al, 1993). However, when organizational commitment is broken down into affective commitment (also called attitudinal) and continuance (also called behavioural) commitment, then there are significant differences, women being more likely to have high continuance commitment and low affective/attitudinal commitment scores than men. Dodd-McCue & Wright (1996) in their study of accounting professionals, used a job model which sought to explain attitudinal commitment for men and women as being shaped by work experiences. They operationalised attitudinal commitment by measuring job satisfaction and job involvement, each with a single item statement (I think/don't think this is the best job I've ever had; I think/don't think about working somewhere else), which could be seen as a rather limited operationalisation. They found that women were less committed than men, and it seemed to be work influences which shaped the organizational commitment of men and women. However, these results may not be generalisable across professional women to women in engineering. Professional women engineers work in a very different environment to accountants, many of whom work as specialists in non-accounting organizations, or in smaller accounting firms.

5.2. Managerially Perceived Commitment of Women: Women professionals, therefore, are more likely to score low on the affective organizational commitment measures. There may be an important consequence of being rated as low on attitudinal commitment, as Shore, Barksdale & Shore (1995) report in their study of managerially perceived commitment, in contrast to most other studies which use self-rating measures of organizational commitment. The level of managerially perceived attitudinal commitment may be an important factor in the allocation of career-related rewards. Shore et al found that “manager-rated affective commitment was positively related to managerial judgements of employee potential and promotability, as well as to employee ratings of leader reward behaviour”. Hence it is likely that managers make career development decisions based partly on their ratings of an employee’s organizational commitment. Side-bets, or human capital investments building up continuance commitment, according to Becker (1962), were predictors of manager-rated continuance commitment. Shore et al suggest that

managers are more likely to see some demographic characteristics (such as age, tenure, accrued pensions, family location) as indicators of side-bets and hence as high continuance commitment. Gender may be another key indicator, as other studies have shown that females are more likely to have high continuance commitment, and this will be explored in the proposed study. Shore et al's research is important to this study, as it shows that managers perceive those with high affective commitment to have more potential and to be more promotable. The effect of gender on selection for career development is therefore of importance. If women are usually seen to be less affective-committed and hence to have less potential, these are disadvantages when career development opportunities are to be given by managers. Allen, Russell & Rush (1994) also found that "perceived organizational commitment was significantly related to career reward allocation". There is thus some evidence for proposing that perceptions of commitment may have a differential impact on male and female engineers' careers, because of gender stereotyping and managerial assumptions.

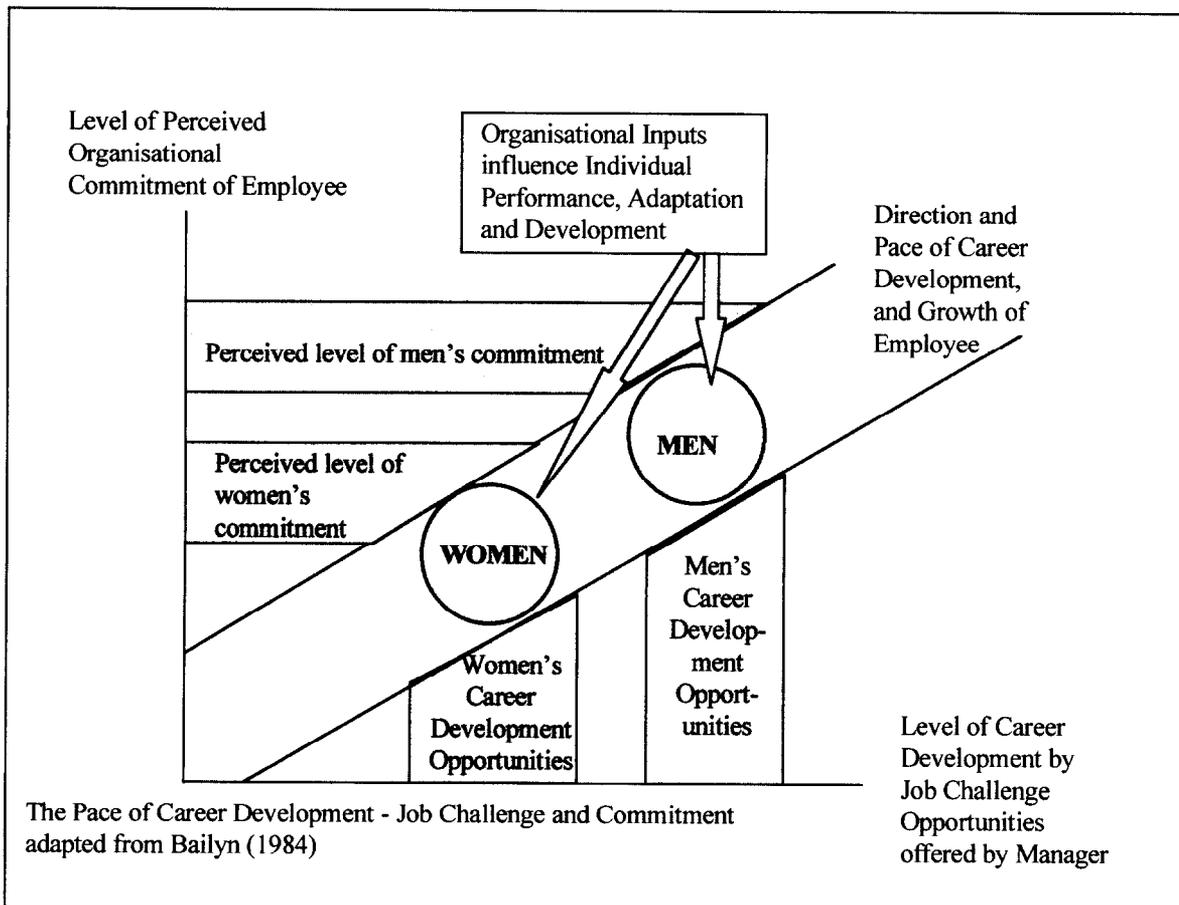


Figure 1: The Pace of Career Development based on Perceptions of Commitment

Figure 1 shows a model based on Bailyn (1984) of the career fit between organizational commitment and the level of job challenge allocated. The single career path fit of Bailyn has been split into male and female career paths. Where commitment is perceived to be less, as often happens in the case for women, they are given lesser developmental opportunities, and their career growth and pace falls behind that of their male colleagues. They may then fall into the category of "career technical professionals by default" (Mainiero, 1986), which in turn lowers their motivation and commitment.

6. The Manifestation of Commitment and its Outcomes

6.1 The Impact of Culture and Structure on Commitment Assessment: Going deeper into this gendered career system, "male" is the norm for managers, and male commitment is never in question. The literature indicates that, on the basis of their own experience, behaviour, assumptions and attitudes towards their organization, and of their human capital acquired, women engineers signal their commitment to their managers, but the signal is interpreted through a "cultural lens" by the manager, and is impacted by that manager's previous experience of women. The cultural lens is created by the organizational culture and the organizational structure (Derr & Laurent, 1989). The culture depends to a large extent on its past, created by male engineers, and reflects the way things are done - for example, the way meetings can carry on after hours because nobody wants to show that they are not fully committed, even though there is no written rule that says they must stay. McIlwee & Robinson (1992) found that the male dominated culture was the key barrier to women engineers' success in the US aerospace industry. In addition to the influence of culture, the structural features of the career system is important. How are people appraised, promoted? How open is the system - do development opportunities get notified to all on a notice-board (or email nowadays), or it is done by a hidden tap on the shoulder and a word in someone's ear? The lens is also created by socialisation experiences of employees. For example, where the male manager has had experience of women in atypical careers, or has a daughter at school studying science and mathematics, then he is less likely to stereotype the women engineers at work (Daniels, 1988). The lens theory comes from a social psychology theory of attribution (Fiske & Taylor, 1991). See Figure 2.

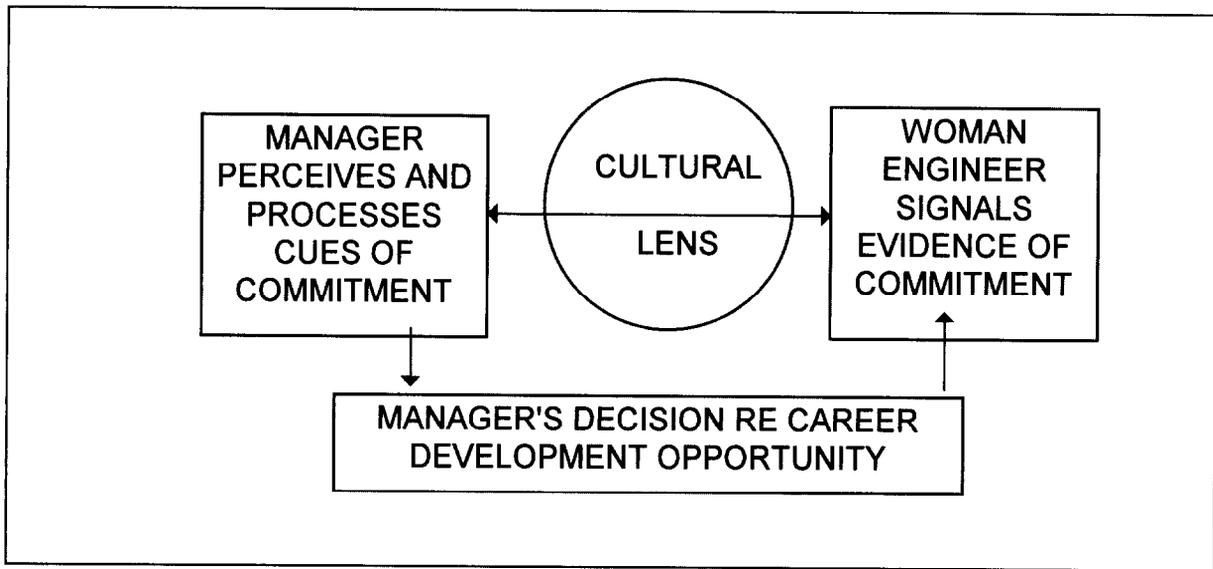


Figure 2: The Commitment Appraisal Process

6.2 Gender and the Commitment Signalling Process: According to Feldman (1981), the signalling of information and its processing by a male manager may be different when the sender is female. Behavioural information about an employee will be stored by the manager in a “fuzzy memory set” for later recall and assessment. However, unless the employee has signalled sufficiently strongly, there is a strong possibility that the manager will categorise on the basis of the main feature of the employee - and here it may be Female Engineer rather than Engineer who happens to be Female. Thus, when recalling the woman’s commitment, he is likely to recall stereotypical behaviour relating to the first category even when this was not what was signalled. In the case of women, it is likely that their commitment will be perceived in relation to whether they are married and/or have children. As engineering skills and commitment are not seen as traditionally female, signals of such competence and attitudes may be overridden by stereotypical models of females. Simply being female may signal that there is too much of a risk for managers to invest in career development. Similar cueing processes occur in impression management, where a subordinate deliberately tries to set up a favourable impression which is retained (Rosenfeld et al, 1995). In the case of women engineers, they may not be communicating to their managers that they have the kind of commitment which is going to be valued by the organization, or indeed

their meaning of commitment may be such that it is not the kind which is valued in senior management positions.

6.3. Previous Studies of Women Engineers, relating to Commitment: Research in the UK has shown that ambitious women engineers in aerospace are giving up the idea of marriage and children for their careers, and yet women engineers are still seen as less committed than their male peers, especially once they are married (Devine, 1992; Evetts, 1993, 1994; Carter & Kirkup, 1990), and few women with children reach senior management. In the US, Bailyn (1987) and Jagacinski (1987) found only very minor differences between men and women engineers' personal characteristics and capabilities, yet few women engineers reached senior management levels. Even in Sweden where equal opportunities measures have long been in place, few women engineers get beyond lower management. Swedish women engineers are marrying and having children, but lowering their career ambition horizons, perhaps to maintain self-esteem, and redefining career success as managing work and family to a balanced level (Wahl, 1992). It is not known whether perceived commitment specifically is a barrier, but a recent study suggests that male perceptions of women as managers are a formidable block for women to succeed in Sweden (Wahl, 1995).

6.4 . Evaluation of Commitment for Engineering Chartered Status: A market case could be made for increasing the numbers of women engineers, in a similar way as the case made for increasing appointments of women to managerial positions in general (Vinnicombe & Colwill, 1995). But despite several UK government-led initiatives, such as the WISE (women into science & engineering) campaigns over the past twenty years, less than a quarter of women engineering graduates go into engineering, and in 1991, that number was down to under ten per cent (HMSO, 1994). But the young women who stay in engineering face another hurdle when they come to seek chartered engineer status - the assessment of their competence and commitment. The UK Engineering Council (1995) has reviewed its system for professional engineer certification, recommending evaluation of competence (from the engineer's record of achievement, qualifications and experience) and commitment (which they define as "to maintain that competence, to work within professional codes, and to participate actively in the profession") to be

evaluated by peer (managerial panel) review. In the case of women engineers, this peer review will almost certainly mean "male review". This definition of commitment is a composite of career, professional and organizational commitment, and as managers will be evaluating commitment as part of their work in organizations, it could be argued that they may evaluate commitment based on their own meanings of a holistic view of the concept.

7. The Rationale for this Study

The rationale for this study is that it should surface any gender differences in meaning of commitment, and explore the impact such differences may have on women engineers' careers. If men and women engineers have different understandings of what commitment is and how it is signalled, then this research project will have an important function: to clarify this issue, and heighten awareness for both women engineers, and for male assessors of commitment to be aware of possible bias.

There may also be differences in meaning at different organizational levels. Dalton, Thompson & Price (1977) identified four engineering career stages. Stage I was the dependent, apprentice stage. Stage II was increasingly independent, working as a colleague. Stage III had its central activity as training and interfacing, assuming responsibility for others and taking a mentoring role. Stage IV was exercising power, sponsoring others, and shaping the direction of the organization. Individuals did not necessarily proceed beyond Stage II. This study is concerned with those in Stages II, III and IV.

8. The Research Propositions

Shore et al's (1995) work showed that perceived lower attitudinal commitment led to perceived lesser potential. It is hoped that this exploratory study will provide sufficient evidence to build on the work of Shore et al (1995) in an engineering context, for testing in a later study of the broad propositions shown below, mapped out in Figure 3.

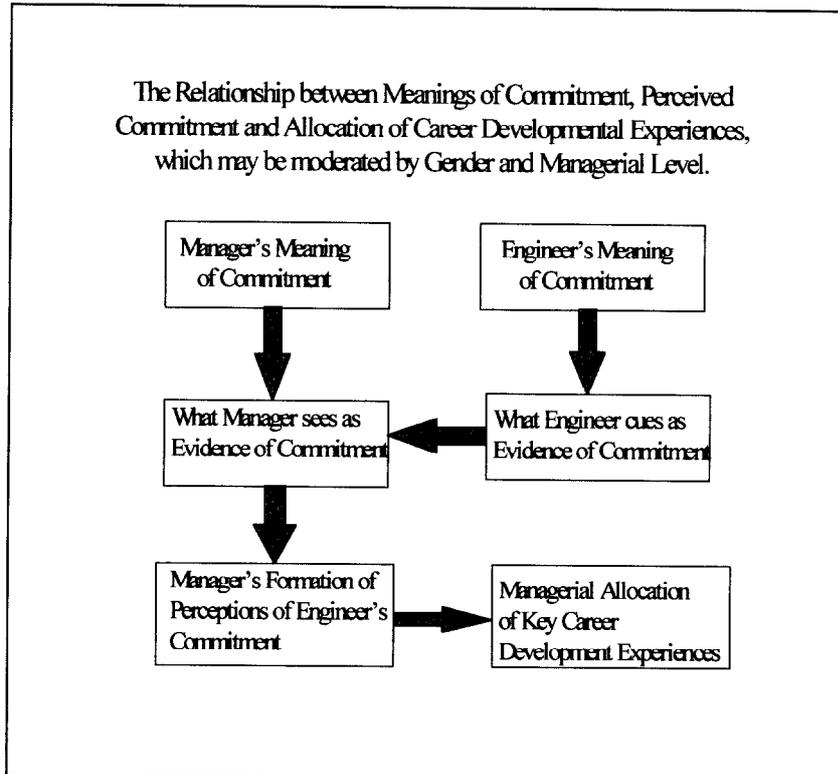


Figure 3: The Relationship between Meanings and Perceptions of Commitment, and the Outcome relating to Career Development Allocation.

Proposition 1: Gender moderates the meaning of commitment to engineers.

Proposition 2: Managerial level moderates the meaning of commitment held by engineers.

Whatever the meanings of commitment are to engineering managers and subordinates, this impacts the perceptions which managers form of their subordinates' commitment, as it influences what they are seeking as evidence of commitment.

Proposition 3: The meaning of commitment held by men and women engineering managers influences their perceptions of subordinates' commitment.

Where male managers are assessing the commitment of female subordinates, they may make different judgements of their commitment based on gender stereotyping.

Proposition 4: Gender influences the relationship between managerially perceived commitment and allocation of career development opportunities.

If men are perceived to be more committed than women engineers, then they may receive more career development opportunities than women.

Proposition 5: The relationship between managerially perceived commitment and allocation of career development opportunities is more favourable for male engineers than female engineers.

It is emphasised that these propositions are broad based, to be explored, as a guide for the semi-structured interviews, rather than hypotheses to be tested in the present study. The broad research question is: How does the meaning of commitment which engineering managers hold relate to the process of commitment appraisal of women engineers?

9. Methodological Considerations

9.1 The Questions: To provide evidence for these propositions, we need to ask a sample of matched women and men engineers and their top managers about their meanings of commitment, how they signal and recognise commitment, and how it influences their allocation of career development to subordinates. Meaning is defined as "the comprehension of social actors, their beliefs, motives, purposes, reasons in a social context, which at one and the same time automatically constitute an explanation of their actions and of the social occurrences to which these give rise" (Jary & Jary, 1991). Questions need to be asked as to what commitment means in a work context, so that it is the engineers' understanding of this construct, rather than organizational commitment in its psychology conceptualisation which emerges. This is likely to result in commitment being described as a value, as attitude and as behaviour. It is planned to ask interviewees to describe senior role models of both genders, to identify what it is that indicates commitment. The engineers would be asked to describe their own commitment, as this is likely to influence what they are seeking in others. We also need to know how they appraise commitment, and for what career development decisions they would take commitment into account. This study should provide useful indications of what engineers mean in terms of commitment, and how they assess it, instead of them

reporting this "gut feel" indicator which may persist and allow gender bias, if it is there, to flourish unseen.

9.2 The Organizations: Four engineering organizations, two in the UK and two in Sweden in the aerospace/power industry have been selected on the basis of similar product and engineering training needs. Often trained in the same few technical universities, engineers move easily between the organizations in their own countries, and sometimes across the two countries. The industry has been chosen because of its importance in economic terms for the UK and Sweden, its leading position in terms of selecting the best graduates, and its technology leadership in the engineering community. It also has a need for high quality engineers with high levels of competence and commitment. (The results may suggest the undertaking at a later point in time of a similar study within organisations with lesser needs for high commitment.)

9.3 The Sample: Through personal contacts in engineering management, the most senior women engineers in these four organizations have been identified. Whilst there are some women engineer directors in one of the UK organizations, there are no women at equivalent level in the Swedish organizations. The senior women are mostly in middle management and lower management levels. Personnel departments have been asked to find male peers matched on age, level and experience. Engineering directors and chief engineers have also been asked to agree interviews for a later stage of the project. The senior managers and matched male peers are included in case there are male or managerial patterns of definitions of commitment, which are different to those of females as individuals and as senior managers. Around 50 interviews are to be held, lasting one to two hours each.

9.4. Rationale for the UK/Swedish cases: Some cases in Swedish organizations have been chosen to reflect the allegedly better organizational flexibility, childcare availability and social benefits for women engineers in Sweden. This introduces the element of cross-cultural issues inherent in any two-country study.

9.5 The Swedish Culture: It is recognised that the Swedish national culture will have an impact on responses coming from Swedish engineers. For example, in terms of management styles, Sweden ranked lowest (with 5) on Hofstede's

masculinity index of 40 countries, whilst Great Britain scored 66, coming 8th (Hofstede, 1984). Feminine cultures tend to be process-oriented, with emphasis on interpersonal relationships, whilst masculine ones are more results-driven, concerned with power and control. However, Gerpott, Domsch & Kettler (1988) state that in high tech companies such as those in aerospace, the sense of technological excellence overrides other considerations, engineers across national boundaries being more likely to share the culture of other engineers than fellow-countrymen. They say that "R&D professionals may form a special occupational subculture across countries, because scientific methods and standards are generally valid independently of country boundaries".

9.6 The Language Issues: There is an issue in that the word "commitment" does not easily translate into one Swedish word. Dictionary definitions include involvement, duty, and dedication, which would cause bias in explanation of meanings, emphasising those three subconcepts above other possibilities. However, engineers in this industry are used to working in English, which is used for management training as well as for technical reports, conference papers and joint projects. It has therefore been decided that interviews will be conducted in English, with discussions in Swedish around any issues which need clarification. This has the advantage of allowing the concepts at first level coding to emerge from the interviewees' own English words, keeping closer to the data.

9.7 The Method: It is considered that sensitively conducted semi-structured interviews should allow the necessary in-depth investigation. A staged approach is being taken, as there are too few women engineers in management to undertake a large pilot study. This staging will allow time for analysis of each stage. Stage 1 is for the women engineers and their matched male peers in the first UK organization. Stage 2 is a repeat of Stage 1 undertaken in two organizations in the same industry in Sweden. Stage 3 is with the second UK organization, followed by a final stage with senior engineering directors of the same organizations. After the interview data analysis, seminars will be held in these organizations to gain feedback from the interviewees on the findings. If appropriate, following the qualitative analysis, a survey to validate the engineers' meanings of commitment may be undertaken.

9.8 The Research Strategy: Case studies of individual engineers is the preferred strategy. There will be no claims to statistical generalisability in this study, but the cases are being chosen for typicality of senior women engineers in advanced engineering organizations. The unit of analysis is the individual engineer's meaning of commitment and perceptions of the commitment appraisal process. Investigation of each case may enable patterns around the contingencies which lead to "events" to be identified as emergent propositions of theory (Yin, 1994), the event being the signalling and assessment of commitment.

Several other options have been considered regarding the appropriate methodology for this study. A survey of a larger number of engineers by questionnaire would not allow sufficient scope or depth, and would not be appropriate for a potentially sensitive subject area. As the study is about the commitment appraisal process, non-participant observation might be an option, but commitment is a cumulative process and one might have to observe managers and subordinates in the workplace for several weeks to observe even one explicit signalling interaction, which could not be evaluated in isolation. In practical terms, this is not an option.

This qualitative study is based on concepts coming from the literature, and the approach recommended by Strauss & Corbin (1990) will be used to develop categories and concepts, to refine the propositions about relationships between concepts, for later testing. The analysis will stay close to the language of the interviewees. The data analysis will involve the use of QSR NUD.IST software to assist in the data management process, to keep the trail of evidence.

10. Implications For Practice

This paper has described the research framework for this project, which should contribute to the literature on women in engineering in several ways. Previous researchers have found it difficult to get access to senior engineering management, and research analysis has been partially confounded by cases in US defence organizations which have stronger reasons to demonstrate affirmative action policies in practice. This study builds on literature from several countries, particularly the Swedish and Norwegian research. It should also contribute to the

organizational commitment literature by adding another perspective which is relevant for industry today. The research should result in a model of the kind of commitment which is sought after in a high-tech industry which requires long term commitment and competence from its best engineers, whether male or female. This model of commitment will come from the engineers themselves, rather than the standard organizational commitment conceptualisations of Mowday et al (1979, 1982), which have tended to remain static during a quarter century of considerable social and economic change in the UK and Sweden, and despite many research papers on commitment antecedents and correlates. It comes at a time when the UK Engineering Council is asking managers to evaluate engineers on their commitment, for chartered status, where women may be at a disadvantage if stereotypical attitudes about women and family responsibilities still prevail. The inclusion of cases from Sweden should indicate whether provision of better childcare and organizational flexibility is enough of a solution for competent and committed women engineers to advance to senior management, as UK researchers (Devine, 1992 and Evetts, 1993, 1994) have suggested earlier. It should be of interest to engineering organizations, who may not be making the most of their women engineers, and who have problems in recruiting top quality graduates, perhaps partly because of so few female role models. This work should be of relevance to women engineers who may understand better what kind of commitment is organizationally valued and rewarded with long term career development. This project should lead to a deeper understanding of women engineers' careers, in a key export industry which now has to function in a global market.

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