

Barriers to women leaders in academia: Tales from Science and Technology.

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There is growing concern regarding the lack of women in senior positions in Science and Technology (ST) in United Kingdom (UK) universities. Previous research has enhanced our understanding of the challenges women in academia face to progress their careers. In contrast relatively little is known as to why so few females reach leadership positions in ST. This article reports on research to examine women's experiences regarding the perceived barriers to leadership in ST faculties in United Kingdom (UK) universities. Using in depth interviews we explore personal narratives to highlight the perceived barriers to career advancement. Findings report on the gendered nature of ST faculties and how women struggle to navigate their careers. The investigation illustrates the effect of organisational influences such as temporary work arrangements, male dominated networks, intimidation and harassment, as well as individual influences such as lack of confidence.

Keywords: Female leadership, academic staff, gender disparity, science and technology (ST), qualitative research.

Introduction

We acknowledge the growing interest in leadership within academia and the call to enhance the development of future professors (Macfarlane 2010; Rayner, Fuller, McEwen and Roberts 2010). In particular there is recognition of the gender inequality at professorial level within Universities (Macfarlane 2012). The lack of females in senior positions within UK academia has received considerable attention in recent years (Athena SWAN 2011; Tapping all our Talents 2012; Zalevski, Tobbell and Butcher 2009). Recent studies report on the continuing under-representation of females at professorial level in UK academic institutions (UCU 2013). The report highlights the lack of women in professorial roles across UK universities the imbalance of gender remains with only 19.8 % of females in professorial positions in 2011. See Table 1 below.

INSERT TABLE 1 HERE

Year	% of professorial staff who are women
2000 - 1	12.6%
2001 - 2	13.1%
2002 - 3	14.2%
2003 - 4	15.1%
2004 - 5	15.9%
2005 - 6	16.7%
2006 - 7	17.5%
2007 - 8	18.4%
2008 - 9	18.7%
2009 - 10	19.1%
2010 - 11	19.8%

Table 1: The representation of women at professorial level in UK higher education

institutions between 2000-1 and 2010-2011. Source: HESA staff record, cited in UCU (2013).

There are a disproportionate number of males at professorial level in UK universities and the male/female ratio widens significantly when we look at science subjects. The number of female academics in professorial roles in these areas is reported to stand at 12% (Athena SWAN 2011). Concerns regarding this imbalance of males at both Senior Researcher and Professor levels in UK academia have been raised by The Royal Society of Edinburgh (Tapping all our Talents 2012). A recent report identifies subjects such as physics the number of female professors have increased since 1991 from only 1 UK female professor, the number still remains low with only 36 out of 650 professors being female. Despite the rise in numbers there remains a fifth of UK university departments having no female professors at all.

In response to concerns about the inadequate representation of females in science subjects a number of initiatives have been launched to support and encourage females to reach leadership roles. One on-going initiative is the Athena Swan Charter launched in 2005 (Athena SWAN 2011). The Charter recognises the commitment made by higher education institutions to advancing and promoting women's careers in science, technology, engineering, maths and medicine (STEMM). Athena Swan bestows UK universities with bronze, silver or gold awards in recognition of their commitment addressing gender equality in their institution or departments.

Considering the under-representation of women in science it is disappointing not

to see more attention given in the literature to explore the reasons for this gender imbalance (Ecklund, Lincoln and Tansey 2012). Whilst the barriers to female leadership in academia, more widely, have been well-reported less attention has been given to women in science, engineering and technology (SET). Consequently less is known about the challenges for female academics assuming leadership roles within SET. Hence the reasons for the under-representation of women in this academic area warrant further investigation. This article aims to extend the current literature by exploring the challenges of female academics working in science and technology (ST) and provide a better understanding of why so few females reach leadership positions.

This paper is organised as follows. We begin with a review of existing literature used to explain why females are under-represented in academic institutions and examine current understanding of the challenges female academics face. We then outline the research approach and the methods used in the study. The findings and discussion of the study are presented, leading to conclusions. Lastly, limitations are noted and importantly areas for further investigation are offered.

Why are there so few women in senior positions in ST?

The challenges for women reaching leadership positions in academia are complex and well documented (Freedman 2012; Kjeldal, Rindfleish and Sheridan 2005; Knights and Richards 2003; Nazemi, Mortazavi and Borjalilou 2012; Nguyen 2012; Priola 2007; Probert 2005; Wolfinger, Mason and Goulden 2008). Authors have identified a range of factors that act as barriers to women working in Higher Education; gendered institutional cultures (Bailyn 2003; Barnard, Powell, Baglihole and Dainty, 2009;

Priola 2007; Probert 2005; Rhoton, 2009); formal and informal gendered practices (Kjeldal, Rindfleish and Sheridan, 2005; Moss-Racusin, Dovidio, Brescoll, Graham and Handelsman 2012; van den Brink, Benschop and Jansen, 2010); individual factors (Powell, 2000) and caring responsibilities (Adamo 2013; Fox 2010; Fox, Fonseca and Bao 2011; Goulden, Mason and Frasch, 2011; Nazemi et al, 2012). The challenges for women in Science and Technology disciplines seem to be especially problematic (Barnard, Powell, Baglihole and Dainty, 2009; Rhoton 2009).

At what stage of their career are the challenges most felt?

Problems appear to begin from the recruitment process (Grove 2013). Authors identify a lack of gender equality in the recruitment and selection of candidates and in particular the lack of transparency and accountability in institutional processes (Settles, Cortina, Malley and Stewart 2006; van den Brink, Benschop and Jansen, 2010). Despite efforts to embrace formal policy frameworks, informal gendered practices exist (Bailyn 2003; Kjeldal, Rindfleish and Sheridan 2005). Studies within SET have identified women candidates are discriminated against if they are pregnant or have children (Mason 2008). Other authors have identified female candidates are less likely to be hired because they are viewed by both male and female assessors as less competent than male candidates (Moss-Racusin, Dovidio, Brescoll, Graham and Handelsman 2012). These biases highlight the gendered practices that women face at the entry stage of their career into science disciplines.

The challenges women face continues throughout their career in academia.

Several authors have focussed on the impact that publication outputs have on women's

careers (Fox 2005, 2010). Leahey (2006) identified that women's productivity rates are lower than men's and argues this is a negative factor in an environment where publication outputs are a key metric for promotion. For women within SET the challenge of gaining publications and acquiring funds for research appears to be made greater by gender discrimination identified in the peer review scoring process (Wennerås and Wold, 1997). More recent research claims that gender disparities are declining (Ceci and Williams, 2011) however, subtle gender disparities are still apparent in scholarly authorship (West, Jacquet, King, Correll, and Bergstrom, 2012). In addition West et al (2012) identifies in some fields male authors predominate in the prestigious first author position. This is an important factor for women working in ST faculties since they are unlikely to gain promotion to senior positions within their institutions unless they are able to demonstrate their ability to obtain grants and publish research papers in peer reviewed journals.

In addition to gendered practices found to exist at the initial selection stage, studies have identified similar bias in the evaluation of professorial candidates (van den Brink and Benschop 2012). Promotion to Reader and Professorial level requires endorsement from Peers both within and external to the academic institution. Male candidates are seen to have the advantage of male networks to encourage and support senior level promotion women do not (van den Brink and Benschop 2012). Many authors have recognised 'boys club' exists within SET disciplines and this acts against women's progression of their careers to senior levels (Barnard, Powell, Bagilhole and Dainty, 2009). As social networks are considered a form of social capital, they offer advantages to the individual as well as the organisation and therefore if women are less

able to access the networks they are disadvantaged (Ibarra, Kilduff and Tsai, 2005).

The gendered nature culture and practices within academic institutions work against women gaining seniority within SET faculties. From an initial review of a candidate's Curriculum Vitae to selection interviews and promotional boards the influence of male selectors appears to disadvantage female applicants.

What influence does the male dominated culture have on women?

The lack of women in senior positions in itself acts as a barrier to more women reaching higher levels within institutions. The absence of 'top tier' women perpetuates the dominant male culture in academia and more women are needed in senior roles to encourage others to aspire to senior level positions (Fox 2005). Women therefore find themselves working in a gendered institutional culture and with few female role models. Perhaps this in part explains the lack of women in senior roles in ST, although a number of other significant challenges have also been identified.

Many authors highlight the gendered culture within institutions as a key barrier for women progressing their careers (Fisher 2007; Fotaki 2013; Knights and Richards 2003; Maranto and Griffin 2011; Rhoton 2009). Part of this incorporates women report feeling marginalised, leading them to be disadvantaged compared to their male counterparts (White 2003). Further exploration into why women feel disadvantaged during their career requires further development as this is currently lacking in the literature.

In some cases the male dominated culture within ST has led to a darker side,

with women experiencing sexual harassment in the workplace. Studies have identified women are exposed to sexism and harassment from male counterparts and senior colleagues within SET environments (De Welde and Laursen, 2011; Rosser and Lane, 2002; Settles, Cortina, Malley and Stewart 2006). Such experiences may account for why some women leave ST altogether.

Is it down to the individual?

Similar to the challenges faced by women in other professions, ‘person-centered’ factors relating to women’s individual personality traits have been identified as a career barrier for women (Powell 2000). To have successful careers in such male dominated cultures as SET, the need for women to have academic and relational self-efficacy beliefs is greater than in other disciplines (Zeldin and Pajares 2000). Self-efficacy beliefs enable individuals to overcome hardships and be persistent under adverse conditions (Zeldin and Pajares 2000). Such beliefs are seen to give women the perseverance and resilience needed to overcome the career obstacles in male dominated work environments (Zeldin and Pajares 2000). The source of self-efficacy beliefs are derived from women’s relationships that enable them to develop their confidence (Zeldin, Britner and Pajares 2008).

Other authors have drawn on Imposter Phenomenon (IP) to help explain the internal struggle women in academia face (Imes and Clance 1984; Taylor 2009; Jöstl, Bergsmann, Lüftenegger, Schober, and Spiel, 2012).

Although not seen as unique to women (Topping and Kimmel 1985) IP refers to

the internal experience, where the individual believes they are not really bright, despite being high achievers and of high intellect. Often identified in women who have gained high levels of academic achievement, women do not experience the internal feeling of success and hence see themselves as ‘imposters’ (Clance and Imes 1978). The inability to internalise their accomplishments means many see their achievements as a result of luck, working harder or manipulation (Langford and Clance 1993). Individuals with IP beliefs often experience a fear of failure and many will go to great lengths to avoid mistakes or failures (Clance and O’Toole 1987). The fear of failing to achieve promotion to Reader or Professor may in part explain why fewer women apply for senior positions in ST. Doubting their ability to gain promotion is a reason in its own right to create a barrier to career advancement.

Does having a baby affect the career progression of women in ST?

Similar to women in other professions, those working in academia struggle to balance their careers with caring and family responsibilities (Fox 2010; Nazemi et al 2012; Probert 2005). While women in ST face the same challenge balancing childcare and family responsibilities with work as those in other disciplines, some authors argue that it is the interaction of this factor with other challenges such as the high levels of competitiveness that makes this challenge more complex (Adamo 2013). Balancing a scientific career and a family is particularly demanding for women in faculty positions and research roles who have additional pressures of securing grants and funding for their research projects (Goulden, Mason and Frasch 2011). This is especially challenging in institutions lacking family-friendly policies or where policies are undermined by gendered practices (Barnard, Powell, Bagilhole and Dainty, 2009;

Mason, 2008).

From an early career stage, having a baby presents a range of work-life balance challenges for women in SET disciplines (Darisa, Davidson, Korabik and Desmarais 2010; Pell 1996). Work patterns in SET often differ from other disciplines because of the requirement to monitor experiments over the weekend and allocated lab times. This increases the challenge of balancing caring responsibilities with erratic working hours. One area having a baby is seen to influence most for women is the opportunity to gain tenure (De Welde and Laursen 2011; Rosser and Lane 2002). This is seen to be especially problematic because without tenure women are more likely to rely on parttime contracts of employment impacting upon their ability to gain grants and deliver publication outputs, lessening their chances of entering senior positions.

Starting a family is usually accompanied by taking a career break and this can present career challenges for women in any profession, it is especially challenging for women in SET (Ledin, Bornmann, Gannon and Wallon 2007; Goulden, Mason and Frasch 2011). Career breaks reduce networking opportunities, which are particularly important for women in these disciplines (Ibarra 1995).

Balancing dual responsibilities may account for why women in science disciplines are found to have significantly higher interference of both family on work and work on family than male counterparts (Fox, Fonseca and Bao 2011). This leads to the argument, childbirth and marriage are the two largest challenges women face in their careers, resulting in many leaving science altogether (Goulden, Mason and Frasch 2011).

Methods

We adopted an interpretative phenomenological approach utilising a qualitative methodology to explore the personal narratives of women working in science and technology (ST). Such a narrative approach allows us to examine the way that women construct meaning in their work life (Willig 2008) and elicit accounts of their experience in academia.

We chose to interview the participants using semi-structured interviews.

Schostak (2006) refers to interviews as something that individuals feel comfortable with, as we are used to interviews in our daily lives, such as television interviews, recruitment etc. The advantage of semi-structured interviews is that they help facilitate rapport and empathy to gain rich and interesting data (Smith, Flowers and Larkin, 2009). We used an interview schedule to ask what challenges the participants had faced in their career to date. We adopted Spradley's (1979) guide to formulate different types of question that included descriptive, structural, contrast and evaluative content (see Appendix A:

- *Descriptive* questions were asked to collect biographical information such as 'What is your role at the University? How long have you worked at the University?'
- *Structural* questions to develop an understanding of how the participant makes sense of their environment, such as 'What does it mean to be a woman in ST?'
- *Contrast* questions to allow the participant to make comparisons between events and experiences, such as 'Do you prefer to work in a female team or male team?'

- *Evaluative* questions to tease out the participants feelings towards someone or something such as ‘How do you feel about your own career progression?’

The study draws on 20 in-depth interviews with women working in Science, and Technology faculties in three UK universities. The participants ranged in age from 24 to 58. In order to protect the participant’s anonymity we have intentionally not provided a breakdown of the women’s age, job title and location. However the sample includes 10 female academics in science and 10 from technology faculties.

Although the sample size is relatively small and does not allow for the findings to be generalised, the data does provide rich insights into the feelings of women working in academic roles within ST. The participants were identified using a snowball technique (Patton 2002) enlisting the support of the Athena Swan network from each of the academic institutions. This was necessary as the researchers do not work within the ST faculties themselves.

The interviews were recorded with the permission of the participants in line with the ethical guidelines of the University (Smith, Flowers and Larkin 2009; Willig 2008). Verbatim transcribes of the interviews were then analysed by the researchers independently in the first instance to highlight the major themes (Gbrich 2007). In order to ensure reliability, all of the data was double coded. Both researchers undertook a review of the themes to ensure agreement was reached.

Findings and discussion

General findings

The interviewees all discussed the lack of women in senior posts across UK universities and reported the absence of female professors in their own discipline. Many of the participants expressed their concern with the lack of senior female academics in their own institution.

“We don’t have women leaders...the underlying culture within the organisation and certainly the ones I know [other women] are not empowered in this organisation to challenge or reach their maximum potential at all. We haven’t done anything positively, proactively, to engage or promote women to achieve their best”. ST07

Without inspiring women leaders in their own university they felt scant support would be available for their own development to seniority. This confirms previous research highlighting the negative influence caused by the absence of top tier women (Fox 2005). The cycle of senior male leadership suggests that the institutional gendered culture perpetuates reinforcing previous studies (Bailyn 2003; Barnard, Powell, Baglihole and Dainty, 2009; Priola 2007; Probert 2005; Rhoton 2009).

At what stage of their career are the challenges most felt?

From recruitment and selection direct and indirect discrimination was perceived by the respondents. Despite the organisation having policies in place to mitigate gendered practices the respondents reported blatant gender discrimination. Previous research highlights discrimination related to pregnancy and children (Mason 2008). We found gendered practices during the recruitment and selection stage supporting previous research. This finding draws upon the gendered culture within academic organisations

(Fisher 2007; Fotaki 2013; Knights and Richards 2002; Maranto and Griffin 2011).

“I think when [female colleague] interviewed for her job she had to give a presentation to the department and I remember after she left and everyone was asked to discuss. And she was the best candidate by miles but I remember one guy saying ‘Erm yes she’s a really, really good candidate but she’s a woman, what if she has any problem with the children and she has to leave halfway through the day’ and at that point we didn’t even know if she had children” (ST11)

Other forms of indirect discrimination were found. The interviewees argued their successes were left uncelebrated compared to their male colleagues. The lack of recognition impacted upon the respondents’ belief that there was differential treatment between men and women. This finding extends current understanding of why women feel marginalised through the identification of the important role recognition plays in career advancement.

“Well there’s one or two big hitters that have got big research council grants last year and this year...so for example when, and they’re both male colleagues, and when they got their grants the Head of department sent an email round to everybody congratulating the researchers [named] on their grants, when I got mine [grant]...nothing”. (ST 14)

Importantly the women discussed the lack of career guidance and support provided by their university. Many seemed unclear regarding the expectations of their institution to gain promotion. Furthermore interviewees reported they felt ill informed regarding the promotion process as well as discouraged from attempting to align their career

trajectory to the next level of seniority. We also found a lack of understanding regarding the support mechanisms external to the institution such as Athena SWAN initiatives.

What the present research has added is to provide empirical evidence of the importance of career guidance and continued professional development.

Another area exposed is the influence of short term contracts. To date the literature has explored the importance of tenure and how this impacts upon their career choices (De Welde and Laursen 2011; Rosser and Lane 2002). This finding concurs with previous literature however; we extend the notion towards differential treatment of temporary versus full time staff. There was a feeling that opportunities for personal development were limited, the priority is to fulfil a grant leaving limited time to explore career options. In addition the respondents felt pressured into undertaking additional responsibility without direct benefit to their progression within the university. Since the perception is that many temporary roles are held by women there is an inherent disadvantage for women's career advancement in ST.

“If you look at the short term contracts many of them are female in those roles and that is a difficulty, it's not unique to us, but we don't have a good strategy of trying to deal with it, so we just deal with the short term contract staff and just put them at risk near the end of the contract”. (ST07)

“I was always told you never say no [to additional responsibilities] if you don't have a permanent contract...open days fall to female staff”. (ST05)

A core finding is the short term nature of employment within ST led to job insecurity. This is problematic from both the individual and organisations perspective as neither is able to plan for a long term career. This in part may explain why ST disciplines experience more problems with attracting and crucially retaining women.

“Longer term contracts would be helpful, contracts here are for 3 years and then I got extended a year at a time, there’s always that sense of insecurity of not knowing where you will be in 12 months onwards. It’s always there in the back of your mind”. (ST15)

In order to understand the scale of the disparity between men and women’s contracts within ST there is a need for universities to conduct an audit of the gender breakdown for temporary contracts. The study furthers the call to research the link between tenure and women’s career progression in academia.

What influence does the male dominated culture have on women?

A recurrent theme in the interview data was the gendered practices within their university. There was evidence that male networks dominated daily working practices. As a consequence women reported feeling excluded. In line with the literature, we identified the existence of a ‘boys club’ within ST disciplines (Barnard, Powell, Bagillhole and Dainty 2009). The impact of exclusion was perceived to influence career enhancing opportunities such as inclusion on research projects, publications and other research outputs.

“You still have the [senior male colleague] excluding everybody apart from the male colleagues that he wants around him...I think that other men are being included in the

research, the women are being excluded” (ST06)

“I was in a completely female group there but the department in general was male and, again, we’d miss out on us knowing a lot of things that were going on because the conversations would happen over coffee or a beer at the pub on a Friday night.” (ST09)

The interviewees highlighted incidents of bullying behaviour by some male colleagues, providing examples of situations they had experienced. Such harassment has been reported in previous studies (De Welde and Laursen 2011; Rosser and Lane 2002; Settles, Cortina, Malley and Stewart 2006). Many women discussed the effect of bullying that directly impacted their self confidence. In worse case scenarios some reported incidents of situations that left them fearful of their personal safety.

“It’s very male dominated in our school; I think there is a culture of bullying and harassment” (ST14)

“we have...there are a lot of problems, bullying and people being aggressive...I’m talking about big problems, fundamental problems, bullying, aggressiveness, the lack of transparency, the fact that women are referred to as ‘that stupid woman...They [male colleagues] think women should not be there necessarily and, if they are there, they’re there to take notes and not say anything and not speak up”. (ST20)

The excerpts provide palpable evidence of harassment towards female members of faculty. It appears that existing policies to preclude bullying activities fail to address such activities. This leads to the belief that the gendered culture within ST impacts upon the ability of women to remain within the institution and rise to senior positions. In such

circumstance the main priority for women was survival of daily work related activities.

Is it down to the individual?

Undoubtedly the issues already highlighted from the data such as the lack of female role models, temporary contracts, male networks and bullying impact upon the experience of women in the workplace. Overwhelmingly the interviewees revealed a sense of lost confidence.

“My lack of confidence is my biggest challenge.... I don’t want to come off as ‘stupid’ (ST02).

Individual feelings of low confidence appeared to impact upon career advancement. Participants noted that they had precluded themselves from applying for promotion. The women recounted their fear of failing often believing this was due to their lack of confidence, hence their career progression was stifled.

“I think I haven’t had the confidence in the past, I just don’t want to apply and fail, and I think even now, talking about it, I’m sure I will fail”. (ST14)

This perception of inability led some participants to explain that they were not really good enough to be employed in their faculty. Despite being high achievers academically, a frequent finding was that women found themselves doubting their own ability and success within the faculty environment.

“I do feel like a lot of the time I’m faking my way through...I never thought I really belonged here”. (ST15)

“I think I should not be there, any minute I should get up and leave. If I do venture to say anything in a meeting then it’s just glossed over and then someone else [male] will raise it and everyone says ‘that’s great’. (ST05).

The sense of not belonging and an inability to internalise their achievements shows some alignment with individuals with IP beliefs (Clance and O’Toole 1987; Jöstl, Bergsmann, Lüftenegger, Schober and Spiel 2012). This finding reveals a less explored route to explain the challenges women face in their careers within ST.

Does having a baby affect the career progression of women in ST?

The data highlights the spillover of work and non-work related factors. The challenges of career breaks, day to day work hours and job security impact not only work but home life. Undertaking a career break was seen to have a significant effect upon career advancement. In particular participants discuss the impact on their publication record.

“I find it very frustrating that you’re just told that, your publication records inadequate, you’re not going to get anywhere ... it’s where it is due to my career break as a consequence of having children...then it’s absolutely ruthless, in terms of trying to get grants through and I think have I got the energy to fight this through. It also has to work doubly hard when you do get back to try and get your publication record back up. ‘is it worth all this?’”. (ST13)

The impact of publication outputs on women's careers have been explored in previous studies (Fox 2005, 2010; Leahey 2006) and the current study supports the notion that gaining publication outputs is especially challenging for women. Given the importance of publications for career progression the impact of having children on publication output warrants further attention.

Certainly one key challenge to women with children is the anticipated working hours. The results note the challenges of informal working hours that become custom and practice such as breakfast meetings. This precludes some women from participating in decisions made within the organisation. Importantly this can have a direct impact upon their ability to positively contribute towards the organisation.

“we've got a Vice Chancellor who says, you know, that you have to be available to teach from 8 'til 6, he'd like it 8 'til 8...So, you know, we have these great policies, and then the actual reality is just, you know, so much harder” ST10

“I did put up with 8 o'clock meetings and juggled with child care to get there...the organisation is not sympathetic”ST007

This finding does have some alignment with previous research that shows family friendly policies are undermined by gendered work practices (Barnard, Powell, Bagilhole and Dainty 2009; Mason 2008).

Another factor we found influenced the participants careers was their partner. In particular the location of work had to provide the opportunity for dual careers. Whilst this finding is not unique to women, the consideration of location influences career choices and was found to limit opportunities.

Conclusions

This article set out to extend understanding of the barriers that challenge women to reach senior positions within ST. Previous sources have cited the lack of women at professorial level in higher education (UCU 2013) additionally, the number of women in senior roles within science and technology are proportionally fewer (Athena SWAN 2011). This paper explores some of reasons behind the prevailing inequity.

This research contributes to the existing literature on women in academia from a focus on ST. We extend understanding of the challenges women face to reach senior academic positions in ST. The present study has added empirical evidence of how women feel working in an ST academic environment.

A core finding of this research is at each stage of their career, from recruitment and selection to retirement, women struggle to navigate their careers in a gendered environment. In particular the results illustrate the effect of short term contracts upon job security.

The male dominated culture influences daily working practices and the evidence suggests that exclusion from networks limits opportunities for career advancement. Moreover we found the male dominated culture led women to feel intimidated and

consider leaving the organisation.

Undoubtedly individual perceptions of ability challenge many women. The data highlights many women lack confidence in their ability within ST. This lack of selfbelief acts as a barrier to advance their career advancement.

Unsurprisingly, having a baby influences career progression. Our results highlight the issue of informal working hours that become custom and practice. There is therefore a need to consider the nature of spill over of work and non-work related factors. These practices often preclude women from participating in organisational decision making. This is an important finding as this has an impact upon their ability to positively contribute towards the organisation.

The overarching theme from the study was the lack of career guidance and support from the institution. In order to navigate their careers to senior positions women were unclear regarding the expectations to gain promotion. With formal and informal networks dominated by men in ST there seemed to be a genuine reluctance to seek promotion advice. Equally some women were uninformed about the external networks available to support career advancement. This information can be used to develop targeted interventions aimed at ST faculties.

Limitations and future research

The results of the study need to be considered within the context of possible limitations. Women in science and technology faculties provide an interesting sample due to the

acknowledged male dominance that exists. The selection of women in ST and the relatively small sample size precludes generalisability of the findings. We suggest future research incorporates a larger scale sample to quantify the findings of the current study. In addition, further investigation is required to explore the impact of individual factors on career advancement for women in ST. A study of the influence of IP may prove a fruitful avenue of research.

References

- Adamo, S. A. (2013). Attrition of women in the biological sciences: Workload, motherhood, and other explanations revisited. *BioScience*, 63 (1): 43-48.
- Athena Swan. 2011. Annual Report. Equality Challenge Unit. London.
- Bailyn, L. (2003). Academic careers and gender equity: Lessons learned from MIT1. *Gender, Work & Organization*, 10 (2): 137-153.
- Barnard, S., A. Powell, B. Bagilhole, and A. Dainty. 2009. Researching UK women professionals in SET: A critical review of current approaches. *Gender, Science and Technology* 2, (3): 361-381.
- Ceci, S. J., & Williams, W. M. (2011). Understanding current causes of women's underrepresentation in science. *Proceedings of the National Academy of Sciences*, 108 (8): 3157-3162.
- Clance, P. R., and S. A. Imes. 1978. The impostor phenomenon in high achieving women: Dynamics and Therapeutic interventions. *Psychotherapy: Theory Research and Practice*, 15: 241-247.
- Clance P. R. and M. A. O'Toole. 1987. Impostor phenomenon: An internal barrier to empowerment and Achievement. *Women and Therapy*, 6: 51-64.

- Darisa, T., V. J. Davidson, K., Korabik, and S. Desmarais. 2010. Commitment to Graduate Studies and Careers in Science and Engineering: Examining Women's and Men's Experiences, *International Journal of Gender, Science and Technology* 2, (1): 47-64.
- De Welde, K. and S. Laursen 2011. The Glass Obstacle Course: Informal and Formal Barriers For Women Ph.D. Students in STEM Fields, *International Journal of Gender, Science and Technology*, 3 (3): 571-595.
- Ecklund, E. H., A. E. Lincoln and C. Tansey. 2012. Gender segregation in elite academic science, *Gender and Society*, 26 (5): 693- 717.
- Fisher, G. (2007). You need tits to get on round here'Gender and sexuality in the entrepreneurial university of the 21st century. *Ethnography*, 8 (4): 503-517.
- Fotaki, M. (2013). No Woman is Like a Man (in Academia): The Masculine Symbolic Order and the Unwanted Female Body. *Organization Studies*.
- Fox, M. F. (2005). Gender, family characteristics, and publication productivity among scientists. *Social Studies of Science*, 35 (1): 131-150.
- Fox, M. F. (2010). Women and men faculty in academic science and engineering: Social-organizational indicators and implications. *American Behavioral Scientist*, 53 (7): 997-1012.
- Fox, M. F., Fonseca, C., & Bao, J. (2011). Work and family conflict in academic science: Patterns and predictors among women and men in research universities. *Social studies of science*, 41 (5): 715-735.
- Freedman, S. 2012. Perspectives on Collegiality Matters. *The Journal of Academic Librarianship*. 38 (2): 108-114.
- Goulden, M., Mason, M. A., & Frasch, K. (2011). Keeping women in the science

pipeline. *The ANNALS of the American Academy of Political and Social Science*, 638 (1): 141-162.

Grbich, C. 2007. *Qualitative Data Analysis*. Sage: London.

Grove, J. 2013. *Glass ceiling remains in place for female academics*. Global Gender Index, 2013. Times Higher Education.

Ibarra, H. 1995. Race, Opportunity, and Diversity of Social Circles in Managerial Networks *The Academy of Management Journal* 38, 3: 673-703.

Ibarra, H., Kilduff, M., & Tsai, W. 2005. Zooming in and out: Connecting individuals and collectivities at the frontiers of organizational network research. *Organization science*, 16 (4): 359-371.

Imes, S.A., and P.R. Clance. 1984. Treatment of the impostor phenomenon in high achieving women. In C. Brody (Ed.), *Women Working With Women*. 75-88. New York: Snapfinger Publishing Co.

Jöstl, G., Bergsmann, E., Lüftenegger, M., Schober, B., & Spiel, C. 2012. When will they blow my cover? The impostor phenomenon among Austrian doctoral students. *Zeitschrift für Psychologie/Journal of Psychology*, 220, (2): 109.

Kjeldal, S., J. Rindfleish and A. Sheridan. 2005. Deal-making and rule-breaking: behind the facade of equity in academia. *Gender and education* 17, (4): 431-447.

Knights, D. and W. Richards. 2003. Sex discrimination in UK Academia, *Gender and Work Organisation* 10, (2): 213-238.

Langford, J., and P. R. Clance 1993. The imposter phenomenon: recent research findings regarding dynamics, personality and family patterns and their implications for treatment, *Psychotherapy*, (30): 495-501.

Leahey, E. (2006). Gender differences in productivity research specialization as a

missing link. *Gender & Society*, 20 (6): 754-780.

Ledin, A., L. Bornmann, F. Gannon and G. Wallon. 2007. A persistent problem.

Traditional gender roles hold back female scientists. *EMBO Reports* 8, (11): 982–987.

Macfarlane, B. 2010. Professors as intellectual leaders: formation, identity and role. *Studies in Higher Education*. 36 (1): 57-73.

Macfarlane, B. 2012. Whisper it softly, professors are really academic developers too. *International Journal for Academic Development* 17, (2): 181-183.

Maranto, C. L., & Griffin, A. E. (2011). The antecedents of a ‘chilly climate’ for women faculty in higher education. *Human relations*, 64 (2): 139-159.

Mason, M. A. 2008. Do babies matter in science? *The Chronicle of Higher Education*, 17.

Moss-Racusin, C. A., Dovidio, J. F., Brescoll, V. L., Graham, M. J., & Handelsman, J. (2012). Science faculty’s subtle gender biases favor male students. *Proceedings of the National Academy of Sciences*, 109 (41): 16474-16479.

Nazemi, S., S. Mortazavi, S., and S. Borjalilou. 2012. Investigating factors influencing women’s inclination in adopting managerial positions in Iranian higher education, *Interdisciplinary Journal of Contemporary Research in Business* 4, (7): 722-732.

Nguyen, T. H. L. 2012. Barriers to and facilitators of female Deans’ career advancement in higher education: an exploratory study in Vietnam. *Higher Education*, 1-16.

Patton, M. Q. 2002. *Qualitative Research and Evaluation Methods*, (3rd Ed) Sage: London.

- Pell, A. N. 1996. Fixing the leaky pipeline: women scientists in academia. *Journal of Animal Science* 74, (11): 2843-2848.
- Powell, G. N. 2000. The glass ceiling: explaining the good and bad news. *Women in management: Current research issues*, 2: 236-49.
- Powell, A., B. Bagilhole, and A. Dainty. 2009. How women engineers do and undo gender: Consequences for gender equality, *Gender, Work and Organisation* 16, (4): 411-428.
- Priola, V. 2007. Being female doing gender. Narratives of women in education management. *Gender and Education*, 19 (1): 21-40.
- Probert, B. 2005. I just couldn't fit in: gender and unequal outcomes in academic careers. *Gender, Work and Organisation* 21, (1): 50-72.
- Rayner, S., M. Fuller, L. McEwen and H. Roberts. 2010. Managing leadership in the UK university: a case for researching the missing professoriate? *Studies in Higher Education* 35, (6): 617-631.
- Rhoton, L, A. 2009. Distancing as a gendered barrier: understanding women scientists' gender practices, *Gender and Society* 25, (6): 696- 716.
- Rosser, S.V. and E. O. Lane. 2002. Key Barriers for Academic Institutions Seeking to Retain Female Scientists and Engineers: Family-unfriendly policies, low numbers, stereotypes and harassment. *Journal of Women and Minorities in Science and Engineering* 8: 161-189.
- Settles, I. H., Cortina, L. M., Malley, J., & Stewart, A. J. (2006). The climate for women in academic science: The good, the bad, and the changeable. *Psychology of Women Quarterly*, 30 (1): 47-58.
- Schostak, J. F. 2006. *Interviewing and Representation in Qualitative Research Projects*,

Open University press.

Spradley, J. P. 1979. *The Ethnographic Interview*. New York: Holt, Rinehart and Winston.

Smith, J, A., P. Flowers, and M. Larkin. 2009. *Interpretative Phenomenological Analysis*. Sage: London.

Tapping all our Talents 2012. *Women in science, technology, engineering and mathematics: a strategy for Scotland*. The Royal Society of Edinburgh: Edinburgh.

Taylor, A. 2009. *The impostor phenomenon: A look at the outside, the inside, and the other side through scholarly personal narrative* (Doctoral dissertation, Colorado State University).

Topping, M, E.and Kimmel, E, B. 1985. *The imposter phenomenon: Feeling phony*. *Academic Psychology Bulletin*, 7 (2): 213-226.

UCU 2013. *The position of women and BME staff in professorial roles in UK HEIs*. London.

van den Brink, M., Benschop, Y., & Jansen, W. 2010. Transparency in academic recruitment: a problematic tool for gender equality? *Organization Studies*, 31 (11): 1459-1483.

van den Brink, M., & Benschop, Y. 2012. Gender practices in the construction of academic excellence: Sheep with five legs. *Organization*, 19(4): 507-524.

Wenneras, C., & Wold, A. (2001). Nepotism and sexism in peer-review. *Women, Science, and Technology: a reader in feminist science studies*, 46-52.

West, J. D., Jacquet, J., King, M. M., Correll, S. J., & Bergstrom, C. T. 2012. The role of gender in scholarly authorship. arXiv preprint arXiv:1211.1759.

- White, K. 2003. Women in leadership in higher education in Australia. *Tertiary Education and Management* 9, (1): 45-60.
- Willig C. 2008. *Introducing Qualitative Research in Psychology*. McGraw Hill: Berkshire.
- Wolfinger, N., M.A. Mason and M. Goulden. 2008. Problems in the pipeline: *Gender, Marriage and fertility in the Ivory Tower* 79, (4): 388-405.
- Zalevski, A. R. Tobbell and J. Butcher. 2009. Female Attrition, Retention and Barriers to Careers in SET Academic Research. UKRC Report.
- Zeldin, A. L., & Pajares, F. (2000). Against the odds: Self-efficacy beliefs of women in mathematical, scientific, and technological careers. *American Educational Research Journal*, 37 (1): 215-246.
- Zeldin, A. L., Britner, S. L., & Pajares, F. 2008. A comparative study of the Self efficacy beliefs of successful men and women in mathematics, science, and technology careers. *Journal of Research in Science Teaching*, 45 (9): 1036-1058.

Appendix 1. Interview Questions

Descriptive

What is your age?

What is your marital status?

Do you have caring responsibilities?

What is your role at the University?

How long have you worked at the University?

What was your previous employment and role?

Structural

What does it mean to be a woman in ST?

How do you feel about your current work environment?

What opportunities do you believe there are for promotion?

Contrast

Do you prefer to work in a female or male team?

How does your current employment compare to you previous role?

Evaluative

How do you feel about your own career progression?

How do you feel about tenure arrangements?

How flexible are your current working hours?

Is there anything else you would like to add?