

Enabling Knowledge Flow: Retaining Graduate Women in the Singapore Construction Industry

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Abstract: As extensive resources are expanded in transferring knowledge from universities to undergraduates, it is important for them to enter the workforce upon graduation to enable the knowledge to flow to the industry. The aim of this study is to investigate the extent to which knowledge flow is disrupted because graduate women are not entering the Singapore construction industry to ensure its sustainable growth. This study used a structured questionnaire, with data collected from 116 construction-trained graduate women via postal survey. Results show that 58% of them chose not to enter or are considering leaving the construction industry. The disruption in knowledge flow is due to better prospects in other industries (pull factor) and poor job conditions within the construction industry (push factor). To retain graduate women in the construction industry, it is recommended that employers: introduce flexible work schedule; allow graduate women to work from home; and give them the same opportunities as their male counterparts.

Keywords: Graduate women, Knowledge flow, Work-family conflict, Gender discrimination

INTRODUCTION

Universities have the responsibility of imparting both hard and soft knowledge to students. Upon completion of studies, these graduates are expected to enter the workforce, preferably in their area of specialisation. There is, thus, knowledge flowing from universities to undergraduates, and upon graduation, from the graduates to the industry. This flow of knowledge achieves

the short term objective of providing the industry with skilled professionals, and a long term objective of ensuring the construction industry has sustainable growth and balanced development.

In Singapore, after undergraduates acquire knowledge in architecture, engineering, building and quantity surveying in the universities, some of the knowledge is lost because many graduate women do not enter the construction industry upon graduation. The Singapore Labour Force Survey reported that women constitute 42% of the local labour force, but only 15% of the construction industry's local labour force are female (Ministry of Labour, 1999). This trend is also observed in

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other countries, whereby the construction workforce remains overwhelming male (Dainty et al., 2000; Sommerville et al., 1993; Fielden et al., 2000; Bennett et al., 1999).

The aim of this study is to investigate the extent to which knowledge flow is disrupted because graduate women are not entering the Singapore construction industry. The objectives of this paper are to: (1) investigate the problems faced by female graduates in the construction industry, and (2) explore female graduates' preferences to retain them in the construction industry so as not to disrupt knowledge flow. Retaining trained female graduates is important to help the construction industry have a healthy and sustainable growth through a regular supply of manpower. Sommerville et al. (1993) have shown that women are more than capable of performing the tasks undertaken by their professional male counterparts. Therefore, encouraging more active participation of women at all levels within the industry increases the competition for places and consequently raises the quality of entrants to the industry. Given the benefits that women bring to the construction industry and construction organisations, it is therefore important to attract and retain women in the construction sector. To do so, it is essential that problems faced by women are removed or minimised, in order to reduce stress, enhance job satisfaction and improve the overall image of the construction industry. This

research is positioned within the social and cultural norms and expectations of the Singapore construction industry.

The rest of this paper is organised as follows: The next section reviews the literature to identify work-family conflicts and gender discrimination. The study's research method is then described, followed by a report of the results. The final section discusses the findings and highlights their implications.

LITERATURE REVIEW

The flow of knowledge from universities to undergraduates, and upon their graduation, from these graduates to the construction industry may be interrupted when graduate women choose not to enter the construction industry or leave the industry after a short stint. The status attainment theory attributes women's lesser achievement in the workplace to gender-linked characteristics that women bring with them to work (Sandico and Kleiner, 1999). Dainty and Lingard (2006) found that there is a perceived "choice" to be made between a successful career and a satisfying family life. Some women are forced to adopt career focused lifestyles to gain vocational success (Dainty et al., 2000). Evetts (1996) found that some women in construction do not see management as an appropriate path for them because of family commitments. Past studies

have shown that long working hours is related to high work-family conflict (Arora et al., 1990; Aryee, 1993). In particular, there is a positive relationship between parental demand and work-family conflict for women professionals (Aryee, 1993). For married women, their commitment to career may be impeded by parental and household responsibilities (Lee and Choo, 2001; Burke, 1999; White, 1995).

Greed (1991) found that women in "traditional male professions" are not promoted further than middle management but are generally pushed horizontally into specialist areas. Wilkinson (1992) investigated employers' attitude towards women in engineering in relation to career paths and childcare. 64% of the employers admitted that female engineers appeared to have to work harder than male engineers for promotion.

The construction industry is viewed as a male dominated and threatening environment, with an ingrained culture characterised by masculinity, conflict and crisis (Gale, 1992; Loosemore and Galea, 2008). A study by Fielden et al. (2000) uncovered a macho environment where sexual harassment within the construction industry is a real concern. A woman's advancement may be hindered because of gender

discrimination in a male-dominated industry (Hurley and Giannantonio, 1999). Dainty et al. (2000) investigated the careers of men and women in large UK construction companies. They discovered a workplace environment which excluded and undermined women through discriminatory, hostile and exclusionary workplace cultures. Resentment against women is manifested by overt harassment and bullying, and covert discrimination in the form of long working hours. However, instead of doing nothing about their plight, Agapiou (2002) found that women are now finding ways of working that are more likely to ensure a smooth experience for themselves.

The studies above show that women in the UK construction industry have progressed at slower rates, and have to confront a greater number of obstacles in their careers compared to men. However, hitherto, no comprehensive study has been done on graduate women in the construction industry in Singapore, and the extent to which they contribute to knowledge flow and balanced development of the construction industry. This study therefore focuses on problems that graduate women face in the construction industry, and the possible solutions to overcome these problems so that knowledge flow would not be disrupted by these graduate women leaving the construction industry prematurely.

RESEARCH METHOD

Data collection for this study was through a questionnaire survey of female graduates who work in the Singapore construction industry. A questionnaire was designed to collect the necessary data. Section A contained general questions for the purpose of data classification. Subsequent sections were for respondents who were still working in the construction industry. From the literature review, problems that female professionals are likely to face are listed in Section B. Some relevant references are: long working hours (Dainty and Lingard, 2006); difficulty in balancing work and family commitments (Dainty and Lingard, 2006); not given equal opportunities (Hurley and Giannantonio, 1999); limited promotion prospects (Greed, 1991); low salary increment (Wilkinson, 1992); and sexual harassment (Fielden et al., 2000). Respondents were asked to rate, on a five-point Likert scale, the severity of the problems, where 1 = no problem at all, and 5 = very serious problem. Likert scale has some limitations because respondents' experiences are subjective and inexorably linked to the socio-culture nature of the construction workplace. However, this method was still chosen because the responses could be quantified and statistical analysis undertaken.

Section C comprised possible solutions obtained from literature review that may alleviate the problems that they

face. These are broadly divided into improving work environment and reducing gender discrimination. Some relevant references to improve work environment are: reducing workload and introducing flexible work schedule (Sandico and Kleiner, 1999; Court and Moralee, 1995). Some of the measures to reduce gender discrimination include: adopting equal opportunities policy in the firm (Rutherford, 1999); increasing representation of women in senior positions (Hede, 1995); and recruiting more female staff (Loosemore and Galea, 2008). Respondents were asked to identify which solutions are effective. They were also invited to propose other measures. However, no new proposals were given.

For the study, the target population was female graduates who hold degrees that are closely related to construction work. The following qualifications were identified: Bachelor of Science (Building) degree for quantity surveyors; Bachelor of Architecture degree for architects; and Bachelor of Engineering (Civil) degree for engineers.

Singapore has two universities that produce these graduates: the National University of Singapore (NUS) and the Nanyang Technological University (NTU). The researchers were unable to obtain the mailing addresses of NTU graduates. Due to a lack of published data, construction professionals with foreign degrees were

excluded. The survey therefore targeted those who obtained their degrees from the NUS. Questionnaires were sent to women who graduated between 1985 and 2000. The mailing addresses of the graduates were obtained from the relevant directories published by alumni associations affiliated to the NUS. The population size was 1350.

Stratified and random sampling were employed in selection of the samples. This was done by dividing the addresses of graduates into stratum with the same year of graduation. Six female graduates were chosen by random sampling from each year of graduation.

Profile of Respondents

A total of 270 questionnaires were mailed out, 90 to each category of degree-holder. A total of 116 respondents replied, achieving a response rate of 43%. The characteristics of the respondents are shown in Table 1. The majority of respondents are above 29 years old and hold the BSc (Building) degree. Of these, 78 (67%) respondents are still practising in the construction industry, and the majority are in the public sector. Only the 78 respondents who are still practising in the construction

industry proceeded beyond Section A of the questionnaire.

RESULTS

Disruption of Knowledge Flow

Of the 116 respondents, 38 (33%) have left the construction industry. The respondents who are still in the construction industry were asked if they are considering leaving it in the near future. There are 49 respondents (63%) who are not leaving, while 29 (37%) indicated that they are considering leaving. The percentage of those who are leaving and their degrees are as follows: Building - 68%, Architecture - 24% and Engineering - 8%. This shows that of the 116 respondents, 33% have left and 37% are considering leaving the construction industry. While the statistics appear to be high, the "intention to leave" is not equal to "actual leaving." This is maybe because one's behaviour is constrained by various external factors while one's intention is not.

Table 1. Respondents' Profile.

Demographic characteristics	Respondents who left construction		Respondents who are in construction		Overall respondents	
	N = 38	Percent	N = 78	Percent	N = 116	Percent
Age						
20–24	3	7.9	3	3.8	6	5.2
25–29	9	23.7	34	43.6	43	37.1
30–34	17	44.7	18	23.1	35	30.2
35–39	9	23.7	23	29.5	32	27.5
Type of degree						
B. Sc (Building)	7	18.4	49	62.8	56	48.3
B. Architecture	14	36.8	18	23.1	32	27.6
B. Engineering	17	44.7	11	14.1	28	24.1
Employment Status						
Salaried employee	31	81.6	78	100.0	109	94.0
Self-employed	2	5.3	0	0	2	1.7
Unemployed	5	13.1	0	0	5	4.3
Type of company						
Contracting firms	-	-	24	30.8	24	20.7
Consulting firms	-	-	20	25.6	20	17.2
Property development firms	-	-	4	5.1	4	3.4
Public sector organisations inside construction industry	-	-	30	38.5	30	25.9
Firms outside construction industry	33	86.8	-	-	33	28.4
Unemployed	5	13.2	-	-	5	4.3

Note: Rounding off errors may have occurred in calculating percentages.

Of the 33% who left the construction industry, knowledge flow is disrupted. The loss is serious in terms of financial investment in these graduates' training and education. From the employer's perspective, having a high employee turnover is expensive. Not only are all the significant expenses spent on them wasted, replacements must also be found, resulting in possible delays and productivity loss (Khazanet, 1996).

The respondents who have left the construction industry offered several reasons for doing so (Table 2). The top reasons are: better prospects in other industries, personal reasons and poor job conditions.

Table 2. Reasons for Leaving the Construction Industry.

Reasons for leaving construction industry	Frequency	Percentage
Better prospects in other industries	27	71
Personal reasons	27	71
Poor job conditions	21	55
Job did not meet with expectations	14	37
Family commitments	9	24
Others	4	11
Gender discrimination	3	8

It is not surprising that the most common reason for leaving the construction industry is the better prospects in other industries, and this reason would apply to both male and females. Compared to other sectors, construction sector experiences negative/low growth rates. With unfavourable growth rates, career opportunities and prospects in the construction industry are bleak. Consequently, it will lose valuable human assets to more promising sectors. Besides poor prospects, construction industry also suffers from a poor image, which makes both men and women reluctant to work in it (Fielden et al., 2000). A-level students and undergraduates admitted that the status of the construction industry as a career opportunity does not compare favourably with other options (Harris Research Centre, 1989).

Except for "personal reasons" which does not tell why a respondent left the construction industry, the other significant reasons (better prospects in other industries, poor job conditions, and job did not meet with expectation) all indicate that the principal motive for leaving is dissatisfaction with the profession and industry. Common reasons for dissatisfaction include lack of rewards and personal development, exhaustion resulting from the life-style required by the profession and conflict between the requirements of the worker and other roles (Teixeira and Gomes, 2000).

DISCUSSION

Problems Faced by Women in Construction

Respondents were asked to indicate the seriousness of 15 problems (identified from the literature) that they may face

in their current employment. The mean ratings are calculated (Table 3). The findings are discussed together with the reasons for leaving the construction industry (Table 2).

Table 3. Results of Job Problems Faced by Female Graduates.

Rank	Problems	Mean Score*	SD
A. Organisational Environment Issues			
A1	Workload is too heavy	3.70	0.988
A2	Work environment is too stressful	3.51	0.941
A3	Working hours are too long	3.47	1.021
A4	Difficulty in balancing work and family commitments	2.79	1.351
A5	Job is not challenging or satisfying	2.64	1.075
A6	Work is too mundane	2.45	0.953
A7	Difficulty in getting accustomed to work after career break/childbirth	1.81	1.170
A8	Problem of carrying out site work during pregnancy	1.77	1.213
B. Gender discrimination issues			
B1	Not being given equal opportunities to perform as compared to male colleagues of the same calibre	2.29	1.296
B2	Male subordinates refused to cooperate	2.27	1.253
B3	Limited promotion prospects compared to male counterparts	2.18	1.035
B4	Less salary increment compared to male counterparts	2.16	1.089
B5	Welfare benefits not as attractive as male counterparts	1.90	1.071
B6	Sexual harassment by male employer/superiors	1.43	0.802
B7	Sexual harassment by male colleagues	1.39	0.632

* Mean score calculated from five-point Likert scale, where 1= no problem at all, and 5 = very serious problem.

Organisational Environment Issues

Three serious organisational environment problems (mean ratings above 3) were identified. These relate to very heavy workload (item A1), too stressful work environment (item A2) and very long working hours (item A3).

The top three problems faced by graduate women in construction are consistent with one of the major reasons for female graduates to leave the construction industry (Table 2), which is "poor job condition." "Job condition" is a broad concept, inclusive of working hours, workload and work environment. The inferior working conditions of construction are well documented (Construction Industry Board, 1996), especially its long hours (Dainty and Lingard, 2006). Undoubtedly, the severity of adverse work practices in construction becomes a major impetus of career change for many, and a problem for those who are still in the sector. Whittock's (2002) study found that when women work in sectors in which they are the minority, this heightened visibility pressurizes them into either over-performing (as shown by "workload too heavy, stressful and long hours" in this study in Table 3) or dropping out (leaving the construction industry).

When a graduate woman's workload is heavy, work is too stressful and hours are too long, she is likely to have difficulty combining work and family effectively. The finding

is consistent with Lingard and Sublet's (2002) study which found that the single most important factor in determining relationship quality among married engineers is the number of hours they work each week. Several researchers have found that when work-family conflict is high, job/business satisfaction will be low (Arora et al., 1990; Aryee, 1993; Adams et al., 1996). Thus, there is a need to minimise the obstacles if the potential of professional women is to be fully realised. One of the ways is to adopt a compressed work week by reducing the length of the working week, but increasing the length of the working day, as Lingard et al. (2007) have demonstrated that this arrangement has beneficial impact on employees' work-life balance.

The issues relating to pregnancy (item A8) and childbirth (item A7) received relatively low scores from the overall sample. However, further analysis revealed that more than half (52%) of the older respondents had indicated '3' and above for problems relating to "difficulty in getting accustomed to work after career break/childbirth" (item A7) and "problem of carrying out site work during pregnancy" (item A8). The results also showed that 82% of respondents older than 29 indicated "3" and above for "difficulty in balancing work and family commitments" (item A4). These findings confirm Moen et al.'s (1992) life course approach to studying pathways that lead to health and social integration by incorporating time in order to capture the dynamic interplay between

biography, institutions and social change. For respondents below 30 years old, pregnancy and childbirth issues are not of concern because Singapore women graduates marry late; the median age of first marriage for Singapore female graduates is 27.9 (Department of Statistics, 2006), and also become pregnant later.

It is acknowledged that work-family issues do not apply only to women. There is a large body of research (Lingard and Francis, 2005; Pocock, 2005; Lingard et al., 2007) which shows that men are also seriously impacted by work-family issues. However, this study focused on graduate women, and thus, work-family issues faced by men are not explored.

Gender discrimination issues

Table 2 shows that discrimination is the weakest cause for a move out of construction (item 7). However, it should not be quickly concluded that gender discrimination does not occur in Singapore construction industry. Hede (1995) found that most women under-estimate the effects of invisible barriers that they will encounter, and trends indicate that it will take another 70 years before women can achieve equal representation in managerial occupations. Even in the UK, married women professionals in the predominantly male construction sector encounter

discriminatory mechanisms that are ingrained in the construction culture (Dainty et al., 2000).

"Not being offered equal opportunities to perform as compared to male colleagues of the same calibre" (item B1) and "male subordinates who refuse to cooperate" (item B2) received the highest and second highest ratings of 2.29 and 2.27, respectively (see Table 3). Further analysis was carried out to compare the severity of gender discrimination across the different age groups. The seven individual scores under gender discrimination issues were added up to obtain a total problem score for each respondent. A mean was then calculated for each age group (Table 4). The youngest group of respondents (20–24 years old) felt that they suffered the least gender discrimination with a mean discrimination score of 9.00; while the 25–29 age group had the highest mean at 15.97. ANOVA test result showed that there was a significant difference among the ratings of the different age groups at the 0.05 significance level ($F = 3.042$, $p = 0.034$). One-sample t -tests showed that only the 25–29 age group is significantly different from the total mean score at the 0.05 significance level ($p = 0.048$, two-tailed). The t value could not be computed for the 20–24 age group as its standard deviation is zero.

Table 4. Mean Discrimination Scores in Different Age Groups.

Age Group	Mean discrimination score	Standard Deviation	t value*	Significance (2-tailed)
25–29	15.97	5.568	2.053	0.048
35–39	13.35	6.706	-0.474	0.640
30–34	11.88	4.554	-1.926	0.072
20–24	9.00	0.000	NA	NA
Overall	14.01	5.890		

* Note: Null hypothesis, $H_0: \mu \leq \mu_0$, against the alternative hypothesis, $H_1: \mu > \mu_0$, where μ was the population mean

The youngest group of respondents comprised of fresh college graduates. With limited working experience, they had little opportunities to experience gender discriminatory practices concerning promotion, salary increment and opportunities. On the other hand, the 25–29 age group faced gender discrimination, especially since they have recently commenced climbing the corporate ladder. Many studies have also found a disparity between the career progression of men and women in the construction industry (Mavin, 2001; Dann, 1995; Burke, 1999; Hurley and Giannantonio, 1999).

Enabling Knowledge Flow: Retention of Graduate Women

There are several reasons for retaining graduate women in the construction industry. The most important is that since they make up a large proportion of undergraduates, the departure of this group of trained graduates would disrupt knowledge flow from university to industry significantly. The recommendations are classified into improving work environment (see Table 5) and reducing gender discrimination (see Table 6).

Improving organisational environment

Eight possible solutions to improve women's work environment were presented in the questionnaire and respondents were asked to indicate those that would be helpful. The results are shown in Table 5.

The two most popular measures are: (1) introduce flexible work schedules (89% of respondents chose this); and (2) allow employees to work from home (71%). These measures also allow women to combine work and family life more effectively. These measures are consistent with Khazanet's (1996) recommendations to have a more effective application of women's input. However, working from home may also be stressful.

Table 5. Measures to Improve Work Environment.

Rank	Measures	N	Percentage
1	Introduce flexible work schedule	69	88.5
2	Allow employees to work from home (telecommuting or teleworking)	55	70.5
3	Reduce workload	35	44.9
4	Shorten working hours	24	30.8
5	Give advance notice for overtime work	19	24.3
6	Provide courses for women to update themselves after career break/childbirth	15	19.2
7	Give longer maternity leave	14	17.9
8	Give advance notice for overseas business trips	6	7.7

These two top measures are also in agreement with Court and Moralee's (1995) who found that to encourage women to remain in the building industry, the most important measures are introducing flexible practices, childcare arrangements and career-break schemes. Sandico and Kleiner (1999) also found that flexible work schedule is the most favoured measure. Even small scheduling adjustments to allow workers to meet their family responsibilities more easily and cutting down on commuting time are welcome.

Despite its popularity, flexible work schedules such as flexitime, part-time employment, compressed week, and allowing employees to work from home (teleworking or telecommuting) are rare in Singapore (Lee and Choo, 2001). Lee and Choo (2001) suggested various ways of implementing flexible work schedules. For example, employees can work an eight-hour day by choosing their preferred time. But, they must be in the office during specified "core" hours. They can also be given options to complete a 40-hour week in four 10-hour workdays.

When companies allow telecommuting, employees have the option to work from anywhere at any time. The focus is on output and not necessarily how much time an employee spends in the office. Telecommuting offers greater freedom in work schedules so working women can handle their childcare and household tasks more easily (Lee and Choo, 2001).

Reducing workload (45%), shortening working hours (31%) and giving advance notice for overtime work (24%) are moderately popular with the respondents. Consistent with having relatively little problem with pregnancy and childbirth (items A7 and A8 in Table 3), the related improvement measures are also not well received. 18% and 19% of the respondents indicated that "longer maternity leave" and "providing courses for women to update themselves after career breaks/childbirth" are

useful measures respectively. Even though the formative years of an infant are particularly important, graduate women may not take longer maternity leave or career breaks to nurture their children because they may be afraid of lagging behind their contemporaries. An Australian study found that women believe that having children is incompatible with a construction career (Dainty and Lingard, 2006).

Reducing gender discrimination

Four possible measures to lessen gender discrimination were offered to the respondents. The most preferred measure is to provide equal opportunities for all (see Table 6). This finding is consistent with Court and Moralee's (1995) study which found that three quarters of women in the building industry felt that a commitment to equal opportunities in respect of selection, promotion, advertising and training would be very effective in retaining skilled women within the industry.

With equal opportunities, more women will have the chance to prove their worth and be promoted to higher positions. However, few companies incorporate equal opportunities policies in their corporate policies (Rutherford, 1999). To many in the construction industry, the topics of equal opportunities and women's issues are often

misconceived as irrelevant and idealistic (Construction Industry Board, 1996).

Table 6. Measures to Reduce Gender Discrimination.

Rank	Measure	N	Percentage
1	Adopt equal opportunities policy	45	57.7
2	Increase representation of women in senior management positions	35	44.9
3	Recruit more female staff	6	7.7
4	Enact more legislation to protect women against gender discrimination	6	7.7

The second most preferred measure to reduce gender discrimination is to "increase the representation of women in senior management positions." By putting them in the decision making position, these women may be expected to make changes to reduce gender discrimination that they face. This is consistent with Ferguson and Dunphy's (1991) recommendation that qualified women should be made more visible in organisations by promoting them to positions of real power. This is an effective move for corporations to fit women into the corporate culture and utilise their talents while satisfying corporate needs of loyalty and productivity.

Limitation of Study

The main limitation of this study is the use of cross sectional survey methodology. With cross sectional survey, respondents' ratings are just their views, and the measures to improve work environment and reduce gender discrimination may not be really effective in retaining them.

Another limitation is that their family status was not measured. In Singapore, among graduate women, 29% in the 35–39 age group is unmarried and 27% in the 40–44 age group is unmarried (Department of Statistics, 2006). Due to a high percentage of graduate women in Singapore being unmarried, this question was not asked as it may be off putting.

In future, the findings can be validated with employers, to ascertain the suitability of the measures proposed in Tables 5 and 6. Research on male graduates could also be conducted, to clarify if disruption of knowledge flow is seriously biased on the female side or it is the general condition in the construction industry in Singapore.

CONCLUSION

This study shows that the construction industry is losing some of its valuable human capital, and some amount of knowledge is not flowing through from universities to the industry because 33% of its female graduates have left the construction industry. The most serious problems reflected in the survey points to construction work being stressful, onerous and demanding. However, this is the reality of construction work, and it is recommended that college applicants be informed before they enter the course. The industry could also improve its image, so as to attract and retain talented people. Job conditions in the construction industry can be improved by reducing the workload, making the work environment less stressful and shortening working hours.

Employers must be prepared to adopt flexible working practices to bring the best out of their staff. Some of these include introducing flexible work schedule to allow employees to combine and be successful in their work and family responsibilities simultaneously. To enable teams to work with members who have different working schedule, companies can specify a core period (e.g., 2 pm to 4 pm) within a day in which all staff should be present. In any event, technology makes it possible to combine attendance at work with responsibilities at home through tele-conferencing.

Most graduate women welcome equal opportunities policies, as it will ensure that reward and promotion will be based on merit alone. Companies should formalise their commitment to equal opportunities in order to project an image that is sensitive to women's issues. Measures to ease job problems will not only attract and retain the best talents in construction, but will ensure that knowledge which flows from universities to industry is not significantly disrupted.

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