

Shortage of Skilled Workers and High Turnover in the Information Technology Workforce: What Are the Possibilities for Retention?

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Abstract. High turnover is an important problem for the IT work force. Relatively little is known about effectiveness of organizational practices for retaining personnel. In our study on turnover and retention in the IT workforce, we examined the effectiveness of several of these practices. Data was collected using a web-based survey. Five companies participated in the survey and we obtained the data from over 600 employees in different IT jobs. The results show that several of these practices can be effective in retaining IT personnel. Especially offering part-time work and telecommuting seem to be effective.

Keywords. Turnover intention, Retention, IT workforce, Gender differences.

1. Introduction

Turnover has been a major issue pertaining to Information Technology (IT) personnel since the very early days of computing and continuing in the present (Moore, 2000, Niederman and Sumner, 2003). IT personnel have a strong tendency to leave a current employer to work for another organization. Ever since statistics have been kept, IT turnover has been a problem. Annual turnover in the Information Systems (IS) field ranged between 15 percent and 20 percent during the 1960s and the early 1970s. In the late 1970s, the turnover ran to as high as 28 percent annually and to 20 percent in the early 1980s. By the 1990s, the turnover rate reached 25 percent to 33 percent annually (Jiang & Klein, 2002). Many Fortune 500 firms have 25 percent to 33 percent turnover rate among their IS personnel (Hayes, 1998). The supply-demand gap in the IT labor market (Freeman and Aspray, 1999; Information Technology Association of America (ITAA), 1998, 2002) conceivably exacerbates the IT-retention problem (Moore, 2000).

The “job churning” seems to be related to several factors associated with the digital revolution. Namely, information technologies have short life cycles, requiring continuous hiring of new workers with new skills, as opposed to the more time consuming approach of training current organizational employees (Network, 2000). Determining the causes of turnover within the IT workforce and controlling it through human resource practices is imperative for organizations (Igbaria and Siegel, 1992).

Although women represent an increasingly important segment of the labor force, their turnover rates can exceed 2½ times the turnover rates of men (Chusmir, 1982; Cotton and Tuttle, 1986; Davis and Kuhn, 2003). Female scientists and engineers in industry are more likely to leave their technical occupations and the workforce altogether than women in other fields. Attrition data on female scientists and engineers show

that their exit rates are not only double those of men (25% versus 12%), but they are also much higher than those of women in other employment sectors (CAWMSET, 2000).

Some preliminary work has been done to identify the key barriers to the entrance and retention of women in the IT workforce (e.g., CAWMSET, 2000; ITAA, 2000). Barriers include lack of role models and mentors, exclusion from informal networks, stereotyping and discrimination, unequal pay scales and inadequate work/family balance (ITAA, 2000; CAWMSET, 2000). Other barriers are the perception that women are less dedicated to their jobs due to obligations of children and family, the image of IT work being more competitive than collaborative and the perception of computing as being solitary work, not well integrated into social discourse (ITAA, 2000). Overcoming workplace barriers and increasing retention rates among women will not solve the shortage of skilled IT workers or the high turnover, but it will contribute to the solution, currently and well into the future.

The emerging question, then, is “How can employers change the culture and environment of the IT workplace to accommodate the needs of IT workers?”. In other words: what retention practices are effective? Both job and organizational design approaches have been suggested. An *Information Week* salary survey showed that IT workers ranked “challenge” of their job, “responsibility” and “job atmosphere” as more important than their base salary. QWL, job stability and learning opportunities through job assignments dominated the responses (Meares and Sargent, 1999). Organizational design has also been suggested as an important solution component. A multitude of innovative human resource management practices have been put forward as potential and/or partial solutions: mentoring programs, educational opportunities, flexible hours, telecommuting options, among many others (CAWMSET, 2000; Meares and Sargent, 1999; Carver, 2000; Office of Technology Policy, 1997; ITAA, 2000). However,

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little is known about the effectiveness of these practices for retaining IT personnel, especially women.

There are many factors that can influence job satisfaction, organizational commitment, turnover intention and eventually actual turnover. However, there is little literature on the effectiveness of retention practices. In this paper we examine what retention practices are available to IT employees and which practices are most effective, especially in retaining women.

2. Method

2.1. Procedure

We used a web-based survey to collect the data. For a detailed description of the web based survey system, see Barrios (2003). Five IT companies participated in the study so far. The participating company sent out an e-mail to notify their employees of the survey and two days later we sent the employees an e-mail, describing the study, asking for their participation and providing them with a link to our web based survey. Integrated part of the web based survey management system is an informed consent procedure. The total response rate was 56%. Data collection for this project started in February of 2003 and is still in progress; though for the purposes of this paper, we used data collected up to January 2004.

2.2. Sample

A total of 5 IT companies participated in the study: one large company ($N > 500$), one medium sized company ($N = 200$) and three small companies ($N < 100$). Totally, we collected data from 624 respondents. Twenty-seven cases in the sample have missing data on gender. Therefore, for this analysis we used the data of 324 male employees (54%) and 273 female employees (46%). Respondents vary in age from 20 to 68 years ($M = 39.7$ years). The majority of the sample is married (61%); 9% is living with a partner; 1% is separated; 6% is divorced, 1% is widowed and 9% is single. Fifty-six percent of the respondents have children; 83% of the respondents who have children have children that still live at home. Forty-three percent of the respondents have one or more children younger than 7 years. Ten percent of the women and two percent of the men have a part-time job. Fifty percent of the men telecommute or work remotely from their office as part of their job and 38% of the women. The differences between men and women are statistically significant.

2.3. Questionnaire

In the survey three questions were asked on retention practices. The questions were adapted from Vandenberg et al. (1999). The first question asked employees about retention practices available to them. Employees were asked to check all the options they can take advantage of if they need them (see Table 1). The second question asked: "Overall, are these options *sufficient* for your needs?" on a 7-point scale ranging from 1: no, not at all to 7: yes, most definitely ($M = 5.37$, $sd = 1.51$). The third question asked: "Overall, do you feel that you would be *discouraged* from taking advantage of these options?" on a 7-point scale, ranging from 1: no, not at all to 7: yes, most definitely ($M = 2.71$, $sd = 1.75$). Turnover

intention was measured using a single item: "How likely is it that you will actively look for a new job next year?", on a 7-point scale ranging from 1: not at all likely- 2 -3: somewhat likely- 4- 5: quite likely – 6 - 7:extremely likely (mean = 2.87, $sd = 1.83$).

3. Results

First, we discuss options provided by the company that may help to retain their IT personnel. Secondly we discuss the effectiveness of these options in retaining personnel, using logistic regression analysis with turnover intention as the dependent variable. We focus on gender differences.

3.1. Options provided by the companies to help employees balance work and family/home

In the questionnaire, respondents were asked to answer the following question: "To help employees balance work and family/home responsibilities your company may offer the following options. In the following list please check all the options that you could take advantage of if you need them". The results are shown in Table 1.

Table 1. Options provided by companies to balance work and family by gender

	Men	Women
Flextime	69%	75%
Job sharing	11%	15%
Telecommuting	72%	68%
Maternal or paternal leave time	59%	65%
Extended leaves (more than 3 months) other than maternal/paternal leaves*	37%	47%
Part-time work*	17%	41%
Child care*	16%	23%
On-site child care*	14%	22%
Sick child care, sick days for sick children	34%	32%
Leave for family-related appointments/events*	62%	72%
Elder care*	14%	22%
Other	4%	5%

* Differences between men and women are statistically significant

The results show that companies offer all kinds of practices to help employees balance work and family/home responsibilities. The options most frequently cited by the respondents are: flextime; telecommuting; leave for family-related events; maternal/paternal leave and extended leaves. There are some significant differences between men and women. In general, women report that they can more often take advantage of the following options: extended leaves; part-time work; child care; leave for family related events and care for the elderly.

Respondents were also asked how sufficient these options were for their needs (see Figure 1).

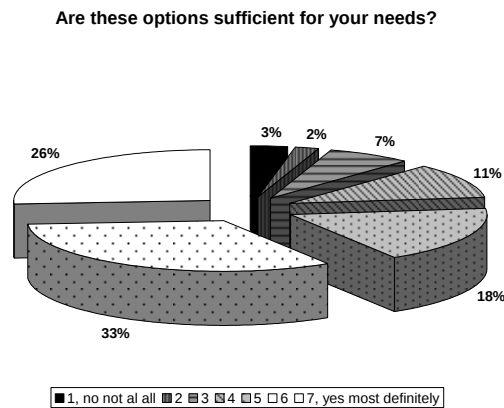


Figure 1. Sufficiency of retention options

The options are sufficient for most employees. On a scale from 1 to 7 (1= not at all, 7 = yes most definitely), a total of 77% (26%+33%+18%) of the employees think these options are largely sufficient. For men (79%) these options are slightly more sufficient than for women (72%).

Respondents who report that these options are not sufficient for them can take significantly less advantage of these options than personnel for whom the options are sufficient. Unfortunately it is not clear whether these respondents have less “access” to these options, or that they simply are not aware that these options are offered by the company. Annual salary is positively correlated ($r=.138$, $p<0.001$) with sufficiency of the options.

The next question asked whether respondents felt that they would be discouraged from taking advantage of these options (see Figure 2).

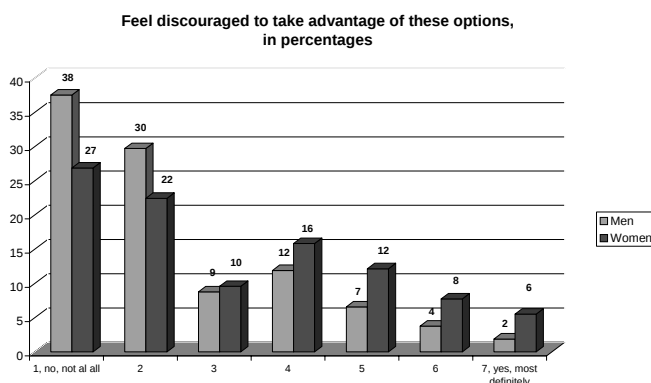


Figure 2. Percentage of employees that feel discouraged to take advantage of options offered by their employer

The majority of the employees (66%) do not feel discouraged to take advantage of these options; and 21% of the employees feel slightly to definitely discouraged. Women feel significantly more discouraged to take advantage of these options than men. Employees with lower incomes feel more often discouraged to take advantage of the options than employees with high salaries.

Respondents for whom the options are not sufficient also feel more often discouraged to take advantage of these options. Of the respondents who think the options are sufficient, only 16% feel discouraged to take advantage of the

options. Of the respondents for whom the options are not sufficient, nearly half (48%) feel discouraged to take advantage of these options. Once again it is especially women who feel discouraged to take advantage of the options, even if they think they are not sufficient. Sixty-three percent of the women for whom the options are not sufficient feel discouraged to take advantage of them.

3.2. Retention practices and turnover

Does providing these practices help to retain IT employees from leaving their job? Turnover intention was measured by a single item: “How likely is it that you will actively look for a new job next year?”, on a 7- point scale, ranging from 1: not at all likely - 2 -3: somewhat likely - 4- 5: quite likely - 6 - 7: extremely likely (mean = 2.87, sd = 1.83). We split the sample into two groups: a group (N=458) with low turnover intention (score ≤ 3) and a group (N=143) with high turnover intention (score > 3).

In Table 2 the results of a comparison between employees for whom these options are sufficient (score ≤ 4) versus employees for whom they are not sufficient (score > 4) and between employees who feel discouraged to take advantage of these options (score ≥ 5) and those who do not (score < 5) are presented.

Table 2. Turnover intention by perceptions of sufficiency and feeling discouraged of taking advantage of retention options by gender

		Turnover intention	
		Men	Women
Are the retention options sufficient?*	No*	3.14 (N=70)	3.29 (N=68)
	Yes*	2.37 (N=248)	2.18 (N=200)
Feel discouraged to take advantage of the options?*	No*	2.41 (N=281)	2.24 (N=202)
	Yes*	3.61 (N=39)	3.14 (N=69)

* Differences between two groups are statistically significant

The results show that the groups for whom the options are not sufficient and who feel discouraged to take advantage of the options have a significantly higher turnover intention than the group for whom the options are sufficient and the group who does not feel discouraged to take advantage of the options offered by the companies.

3.3. Logistic regression analysis to determine the effectiveness of the different options

To determine the effects of the different retention options on turnover intention we performed logistic regression analysis with turnover intention (0=low, 1=high) as the dependent variable. Table 3 shows the results.

Table 3. Logistic regression of turnover intention (0=low, 1=high) on retention options

Retention options	Total		Men		Women	
	Exp (B)	Sig.	Exp (B)	Sig.	Exp (B)	Sig.
Flextime	1.03	0.90	0.95	0.87	1.00	0.99
Job sharing	1.06	0.86	1.04	0.94	1.13	0.81
Telecommuting	0.47	0.00	0.57	0.08	0.33	0.00
Maternal or paternal leave time	0.98	0.95	1.15	0.64	0.73	0.38
Extended leaves	0.95	0.81	0.65	0.19	1.46	0.29
Part-time work	0.35	0.00	0.25	0.01	0.39	0.02
Child care	0.91	0.77	1.29	0.59	0.55	0.25
On-site child care	1.56	0.17	1.30	0.57	2.20	0.09
Sick child care, sick days for sick children	0.93	0.79	0.69	0.28	1.47	0.34
Leave for family related appointments/events	0.80	0.35	0.83	0.54	0.85	0.66
Elder care	1.99	0.02	3.61	0.00	1.24	0.60
Constant	0.64	0.06	0.64	0.15	0.71	0.37

The results show that some options seem to be effective in retaining IT personnel. Most effective seems to be to offer the possibility of part-time work. If part-time work is offered, the Odd's ratio (Exp B) that employees will stay in their job, is nearly three times higher. Interestingly enough this effect is stronger for men than for women (Odd's ratio = 0.25 for men vs. 0.39 for women). Offering telecommuting seems to be effective as well, but more effective for retaining female employees than male employees.

4. Discussion

High turnover in the IT workforce remains a problem, especially when it comes to retaining skilled workers. In this paper we looked at practices to retain IT personnel. The results show that when these options are offered, turnover intention is lower. If personnel are not satisfied with the options, or if they feel discouraged to take advantage of these options, turnover intention is significantly higher. However, the effectiveness of these options can vary for different groups of IT workers (e.g. women, minorities) and in different organizations.

To retain (qualified) personnel, companies have several options. One of these options is to offer personnel options based on Human Resource Management practices; another option is organizational and job redesign. We briefly discuss both strategies.

4.1. Human resource management (HRM) practices

The results of this study show that offering retention options, such as telecommuting and part time work to retain IT personnel can be effective. IT personnel who can make use of these options, who think the options are sufficient for their needs and who do not feel discouraged to take advantage of these options are more willing to stay with their company than those who can not make use of these practices or feel

discouraged to take advantage of these options. More specifically, offering options, such as part time, work seems to be effective both for men and women. Employees who can take advantage of these practices are more than three times more likely to remain with their company. Offering telecommuting seems to be effective for women, but less effective for men.

The options most often available to IT workers are: flextime; telecommuting and various forms of leave (i.e. maternal/paternal leave, extended leaves and leaves for family-related events). In general, women report that they can more often take advantage of these options. However, there are also gender differences with regard to feeling being discouraged to take advantage of these options.

4.2. Organizational design/job redesign

In an earlier study, Carayon et al. (2003) looked at differences in job and organizational characteristics *between* IT and non-IT personnel in a public sector organization and more specifically, at gender differences. Men and women in the IT department of that organization were compared with employees in other departments in the same organization. Results showed that there were unique job and organizational characteristics that affected job satisfaction and job strain of female IT workers. Among IT workers, high work pressure was related to low job satisfaction for women, but not for men. Furthermore, female IT workers who reported high levels of task significance also reported high job strain. This relationship between task significance and job strain seems to be unique for female IT workers (Carayon, Hoonakker, Marchand and Schwarz, 2003). The research literature suggest that technology professionals are particular vulnerable to work exhaustion (Kalimo and Toppinen, 1995; Moore, 2000). The results of our own study (Hoonakker et al., 2004a) confirm that turnover intention indeed is related to high work demands and emotional exhaustion, either directly (male employees) or mediated by low job satisfaction (male and female employees). Therefore, to increase job satisfaction and reduce turnover, jobs should be redesigned to lower job demands (long working hours and too much work to do), and the associated strain.

Additional multiple regression analysis, aimed at identifying interaction effects between job type (IT vs. non-IT) and gender showed no significant differences between QWL for men and women and between IT and non-IT workers. On the other hand, the pathways from job characteristics to QWL differ for these categories of workers (Hoonakker et al., 2004b, this conference). The most important result of the study was that with regard to all measures of QWL, *task identity* (a concept that represents to what extent employees do an entire piece of work (instead of small parts) and can clearly identify the results of their effort) seems to play an important role for women in the IT workforce. Task identity is positively related to job satisfaction and negatively to job strain. Therefore, we recommend that, specifically for female IT employees, job should be redesigned in such a way that female employees are allowed (when possible) to do entire pieces of work and can clearly identify the results of their efforts - instead of assigning them small parts of work- thus increasing job satisfaction, reducing strain and reduce turnover.

As mentioned above, the results of our current study (Hoonakker et al., 2004b, this conference) point in the same direction: the strongest pathway to turnover intention is the pathway from high job demands to emotional exhaustion either directly to turnover intention (male employees) or mediated by job satisfaction (male and female employees). Other strong pathways are the pathway from (lack of) challenge to turnover (women) or mediated by (lack of) job satisfaction (men and women); the pathway from (lack of) career opportunities to emotional exhaustion and (lack of) job satisfaction to turnover and the pathway from (lack of) rewards to (lack of) job satisfaction to turnover, or –in the case of male IT employees- also a direct path from (lack) of rewards to turnover intention. It should be noted that rewards do not equal a higher salary. Research has shown that a higher salary is not the most important reason for employees to change jobs. Important reasons are training opportunities, career advancement and more challenge in the job. The results of our study show that the item in the rewards scale that has the highest (negative) correlation with turnover intention is: “I am satisfied with the amount of *recognition* I receive when I do a good job”.

To retain female employees, supervisory support seems to be crucial. Supervisory support plays a central role in our turnover intention model for female IT employees. Nearly all the relations between job and organizational characteristics, quality of working life and turnover are mediated by supervisory support. The same results were found in the study by Allen et al. (1999) on reasons why college-educated women change employment. Supervisory support probably also plays an important role when employees want to take advantage of HMR practices provided to them, and -especially women- not feel discouraged to do so.

4.3. Study limitations

This study investigated human resource practices available to IT workers. However, we did not examine whether IT workers actually took advantage of specific options. Perceptions of sufficiency of the options and feeling discouraged to take advantage of these options were general questions that related to all options. However, the logistic regression of turnover intention shows the importance of two retention options: telecommuting and part time work IT workers who indicated that telecommuting and part-time work were available options were less likely to turnover. Other study limitations included:

- Data collected from only five companies, therefore limiting the generalizability of the results.
- Data collected via a web-based survey at one point in time.

Because of the cross-sectional study design, we are not able to examine the causality of the relationship between retention practices and turnover intention. In addition, we examined turnover intention, not actual turnover.

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