



Turnover of highly educated R&D professionals: The role of pre-entry cognitive style, work values and career orientation

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Retention of key R&D experts has been recognized as a critical managerial challenge for many technology-based companies. In this study, we propose that turnover of highly educated professional workers is meaningfully related to individual characteristics such as cognitive style, work values and career orientation. We tested the hypotheses using data collected from a sample of 132 R&D professionals with PhD degrees in engineering or natural science in a Korean electronics firm. The time-dependent risk of turnover was estimated by survival analysis using a proportional hazards regression model. The results showed that over the 7-year period after their organizational entry, R&D professionals with high levels of intrinsic values and cosmopolitan orientation were more likely to leave the organization than were their counterparts with low levels of intrinsic values and cosmopolitan orientation. The hazard function showed that the positive effect of intrinsic work values on turnover was particularly salient in the third and fourth year of R&D professionals' organizational tenure. We found that the positive effect of cosmopolitan orientation on turnover increased over time, introducing a greater risk of turnover with increasing tenure. The present findings have practical implications for the retention of highly educated R&D professionals in a corporate setting.

Employee turnover has been an important research agenda for organizational scholars for some time now (Mossholder, Settoon, & Henagan, 2005). Turnover has become an even more critical issue for contemporary knowledge-based organizations because the maintenance of social and human capital is crucial to high performance of knowledge workers (Oh, Choi, & Kim, 2006). The potential deleterious effect of turnover on task performance, intellectual capital and social capital can be particularly serious for organizational functions such as research and development (R&D). In the R&D function,

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tasks and outcomes are defined in terms of creation and application of new knowledge, which often necessitate and depend on highly interdependent work activities characterized by open exchanges of ideas and frequent feedback (Miller, 1986). Turnover of R&D employees can thus lead to discontinuity in developmental projects and a loss of tacit knowledge, which cannot be readily substituted with new recruits. Kochanski and Ledford (2001) estimated that the cost of losing R&D workers is three to six times the cost incurred from the turnover of administrative personnel. For this reason, retention of R&D employees has become a key issue in the R&D management literature (Farris & Cordero, 2002).

The turnover literature has examined the effects on turnover of various predictors including (a) demographic factors (e.g. gender, tenure); (b) workplace characteristics (e.g. leadership, co-worker relationships); (c) employee attitudes (e.g. job satisfaction) and (d) job search-related variables (e.g. alternative job opportunities, job search behaviour) (for a review, see Griffeth, Hom, & Gaertner, 2000). Because of this prevailing focus on proximal and job-related variables, researchers have rarely investigated the influence of individual difference variables on turnover; when they have, results have indicated that these variables have rather limited (often insignificant) effects on turnover (Allen, Weeks, & Moffitt, 2005; Barrick & Mount, 1991; Hom & Griffeth, 1995). However, given the stable and lasting effects of personality variables on many human domains of behaviour (Block, 1971; Magnusson, 1988) as well as the practical benefits of identifying pre-entry risk factors of turnover, it is still meaningful to further investigate potential individual difference variables that may affect employees' withdrawal behaviour.

Recently, Barrick and Zimmerman (2005) pointed out that 'research has focused on understanding why employees leave once they are in an organization. In contrast, there has been little research investigating whether employers can reduce turnover at selection' (p. 159). Addressing this issue, the present study identifies and tests the effects of job-relevant individual characteristics, which were measured at the time of organizational entry, on voluntary turnover in a group of R&D professionals over a period of 7 years. Specifically, we focus on the pre-entry characteristics of R&D professionals that could have critical implications for subsequent turnover (Barrick & Zimmerman, 2005). The R&D professionals' turnover is prone to be affected by their particular professional values and cognitive styles, which may affect their organizational adjustment and decisions to leave. Specifically, to predict turnover of R&D professionals, we examined the effects of their cognitive styles, intrinsic/extrinsic work values and career orientation as measured immediately before their organizational entry. The present study empirically tests the proposed relationships using data collected in a large Korean electronics company.

Characteristics of professional workers

In a study of professional workers, Kerr, von Glinow, and Schriesheim (1977) identified six characteristics that distinguish them from other types of workers: (a) expertise; (b) autonomy; (c) collegial maintenance of professional standards; (d) commitment to the job as a calling; (e) identification with the profession and fellow professionals and (f) ethics or a felt obligation to render service without concern for self-interest and without becoming emotionally involved with the client. This shared set of values or attitudes should be particularly strong among highly educated professionals (e.g. medical

doctors, professors) because length of training is indicative of strength of professional socialization (Miller, 1986).

For this reason, a common problem for professionals employed in non-professional organizations is potentially conflicting loyalties. The early literature suggested that professional workers in organizational settings tend to experience a certain level of conflict between their professional standards/goals and local organizational requirements/goals, which often leads to negative outcomes such as absence, low performance and/or turnover (Aryee & Leong, 1991; Gerpott, Domsch, & Keller, 1988). However, some scholars have maintained that professional and organizational commitment are not necessarily antithetical to each other and are, in fact, positively related (Lee, Carswell, & Allen, 2000; Mathieu & Zajac, 1990; Wallace, 1993). For example, Wallace's meta-analysis showed a moderately strong, positive association between professional and organizational commitment (true population correlation = .43). In Wallace's analysis, the investigation of potential moderators revealed that intensive occupational professionalization decreases the positive association between professional and organizational commitment. The severity of the tension between professional and local organizational goals may also depend on organizational context. Thus, highly educated professionals (with intensive professional socialization) employed in a relatively hierarchical and well-structured organization are likely to suffer from a particularly severe conflict between professional standards and organizational goals, because they are more likely to perceive potent pressure to conform to the goals of the organization. The present study focuses on this category of professional workers (specifically, PhDs in engineering or natural science disciplines working in corporate R&D centres).

Professional workers have relatively low levels of attachment to their organizations and tend to switch employers relatively frequently (Raelin, 1991; von Glinow, 1988). Thus, the turnover rate of R&D-related experts in high-tech companies is fairly high (Lazar, 2001). The loss of R&D professionals with core scientific and technical knowledge can be detrimental to organizational performance, and result in 'ripple effects' on other R&D workers (Michaels, Handfield-Jones, & Axelrod, 2001). The present study expands the literature by identifying and testing individual characteristics that predict turnover of R&D professionals who play a key role in corporate R&D activities – specifically, those holding PhD degrees in engineering or natural science disciplines. R&D professionals with PhD degrees often have high levels of technical expertise and experience in finding and solving new problems in a systematic and creative manner – attributes that are critical for the development of innovative ideas and products (Amabile, 1988). This study thus complements existing empirical findings that have largely been based on other types of professional workers such as accountants and lawyers (Cohen, 1999) or R&D employees with less professional training such as entry-level engineers and technical workers (Finegold, Mohrman, & Spreitzer, 2002).

Predictors of turnover among R&D professionals

Research from the personality, person-environment fit and socialization literature suggests that newcomers enter organizations with attitudinal predispositions and commitment propensities (Kammeyer-Mueller, Wanberg, Glomb, & Ahlburg, 2005; Lee, Ashford, Walsh, & Mowday, 1992; Wanous, 1992). From an extensive review of the R&D management literature, we distilled three individual characteristics that have potential

to predict turnover of R&D professionals: cognitive style, career orientations and work values. Researchers have often focused on these individual difference variables when investigating professional workers' organizational commitment and career development (Chan, 1996; Kochanski & Ledford, 2001; Raelin, 1991). Cognitive style is a personal disposition that orients individuals towards a particular way of thinking and problem solving (Kirton, 1976), which has critical implications for their organizational adjustment (Chan, 1996). Work values and career orientation determine the goals that individuals want to achieve and the needs they seek to satisfy at work, which will in-turn shape attitudes such as job satisfaction and organizational commitment (Iverson, Mueller, & Price, 2004). However, there has been no empirical investigation of the effects of these variables on R&D professionals' actual turnover behaviour. Below, we advance hypotheses that link these characteristics to turnover of R&D professionals.

Cognitive style

Cognitive style is a personal disposition that orients individuals towards a particular way of thinking and problem solving (Kirton, 2003), which has critical implications for their organizational adjustment (Chan, 1996). Given that the core task of R&D workers is to initiate technological innovation and develop new products, their cognitive style or basic orientation to problem solving may play an important role in shaping their job perceptions, performance and turnover. In this regard, one of the most widely used frameworks is Kirton's adaptation-innovation (KAI) theory. Kirton (1976) proposed that individuals can be located on a continuum of cognitive style ranging from adaptive to innovative. This cognitive style is considered to be stable over time. Adaptors prefer to operate within consensually agreed-upon paradigms and are skilled at improving current ways of doing things. In contrast, innovators are more likely to reconstruct a problem and tend to perceive the existing paradigm as part of the problem.

Hayward and Everett (1983) have shown that innovators are more likely to leave the organization. However, the sample in that study consisted of employees of a local government and a bank - work environments in which conservative and cautious behaviours tend to be expected and rewarded. In a study of 253 entry-level engineers employed by the Singaporean Civil Service, Chan (1996) found that the effect of KAI on the turnover of engineers was moderated by the style demands of the work context. Specifically, in the staff engineering function, where production and maintenance within a given technological system is expected, innovators were more likely to leave than adaptors over a 3-year period. However, in the R&D engineering function, in which technological development and innovation is important, adaptors were more likely to leave than innovators. This is consistent with the person-environment fit idea that there should be congruence between individuals' cognitive style and the demands of work context.

Considering that R&D professionals with PhD degrees are the key players in R&D projects, and are often regarded as the main source of new ideas and technological breakthroughs, the demand for innovative problem solving may be greater than that for an adaptive or compliant way of thinking. In particular, in the present setting of the electronics company, the cycle of product development and technology was very short and innovation and creativity was highly emphasized and valued by the top management. In this context, R&D professionals with an adaptive orientation (who would experience cognitive misfit) would be more likely to feel stressed and less satisfied, a situation that eventually engenders actual turnover (Chatman, 1991; Griffeth

et al., 2000). Thus, we expect that professionals with an innovative cognitive style will be *less* likely to leave the company than their adaptive counterparts.

Hypothesis 1: Higher levels of innovative cognitive style decrease turnover.

Intrinsic and extrinsic work values

Values refer to desirable, trans-situational goals that guide people's lives (Rokeach, 1973). Work values represent what people want from their work and thus shape the way in which employees view their work experience (Locke, 1976). Because of intensive training, professionals with PhD degrees tend to have clearly defined values and firm convictions about what is important in their work (Miller, 1986). For example, Chatman (1991) found that work value profiles of newly hired accountants remain relatively stable during the organizational socialization process. Insufficient fulfilment of these stable work values after organizational entry will engender 'surprise' (Louis, 1980), which in-turn generates negative reactions on the part of employees in the form of reduced satisfaction and commitment and increased withdrawal intention.

In this study, we consider two different types of work value: intrinsic and extrinsic. Scholars have long investigated the different implications of intrinsic and extrinsic needs with respect to attitudes, behaviour and performance of individuals (Amabile, 1988; Deci & Ryan, 1985). Highly educated professionals tend to have strong intrinsic work values, pursuing autonomy, responsibility, achievement and challenging work assignments (Badawy, 1978). Intrinsic reward from work itself will be even more critical for R&D professionals with PhD degrees because they tend to strongly identify with their professions and to be eager to engage in meaningful and challenging tasks (Harpaz & Meshoulam, 2004; Miller, 1986). In comparison with alternative workplaces for PhDs in engineering and natural science (e.g. government-sponsored research institutes, universities), industry R&D centres tend to be highly controlling and do not provide much room for autonomy or self-driven research activities (Kochanski & Ledford, 2001; Scott, 1965). For this reason, R&D professionals with high intrinsic values will find their work at industry R&D centres less fulfilling than will their counterparts with low intrinsic values. We thus hypothesize that R&D professionals who hold high intrinsic work values at the time of their organizational entry are more likely to leave the organization than those with low intrinsic values.

However, it is unreasonable to assume that professionals do not care about extrinsic factors such as salary, benefits, career advancement and organizational status. Kochanski and Ledford (2001) found that engineers' turnover decisions are significantly related to incentives such as direct financial rewards, indirect financial rewards and career rewards. Apparently, R&D professionals value both intrinsic and extrinsic aspects of their work, and their workplace behaviour (including turnover) will be influenced by both values. When their initial levels of intrinsic and extrinsic values are high, they are more likely to encounter surprises or unmet work-related values (Louis, 1980), which will increase the probability and speed of withdrawal. Therefore, we expect that R&D professionals with high intrinsic and extrinsic work values are less likely to be satisfied with their work and thus more likely to leave.

Hypothesis 2: Higher levels of intrinsic work values increase turnover.

Hypothesis 3: Higher levels of extrinsic work values increase turnover.

Cosmopolitan orientation

Professional workers' career orientations have significant implications for their attitudes and behaviour in organizations (Iverson *et al.*, 2004; Lee *et al.*, 2000). In this regard, scholars have distinguished between cosmopolitan and local orientation (Gouldner, 1957). Cosmopolitans are committed to maintaining the skills and values of the profession to which they belong and are oriented towards success as a member of their professional community. Locals, in contrast, are individuals who identify primarily with and are highly committed to the organization for which they work. Cosmopolitan professionals prefer autonomous work processes, value professional knowledge and are less business-minded than locals, who tend to pursue career advancement and success within the organization (Kerr *et al.*, 1977). Due to the unique values, attitudes and behavioural characteristics they develop through long-term education and intensive training (Miller, 1986), professionals tend to be more strongly committed to their profession than they are to their employer (Raelin, 1991; von Glinow, 1988).

Moreover, cosmopolitan-oriented professionals are more likely to perceive violations of psychological contract than are locals, which increases their intent to leave the organization (Larwood, Wright, Desrochers, & Dahir, 1998). This is because they use rather strict and rigid professional and ethical criteria to judge their work and organizational life, effectively ignoring local contextual specificity (Larwood *et al.*, 1998). In a study based on public school teachers, Iverson *et al.* (2004) found that local-oriented teachers were less likely to leave than their cosmopolitan counterparts. The role of career orientation in workplace behaviour may be even more significant for highly educated R&D professionals, due to their substantial professional socialization. Drawing on these conceptual and empirical findings, we hypothesize that PhDs with strong cosmopolitan career orientation will have higher risk of turnover than those with local orientation.

Hypothesis 4: Higher levels of cosmopolitan orientation increase turnover.

The present study expands on previous turnover research in several ways. First, despite the fact that employee turnover has been one of the most widely studied topics in the area of organizational psychology, relatively little is known regarding possible causes of turnover among highly educated professionals. Thus far, most studies of turnover of professionals have been based on a limited number of professional groups, usually accountants or lawyers (e.g. Cohen, 1999). The present study investigates the turnover behaviour of newly hired R&D professionals with PhDs. Our use of this highly distinctive sample may limit the generalizability of the findings from this study to other samples. Nevertheless, it would be highly beneficial for companies to understand the reasons for turnover of professionals with greater levels of expertise and professional training than other employees.

Second, a number of studies have investigated the effects on turnover of employees' work experience and attitudes (e.g. job characteristics, organizational commitment and co-worker/leader relations etc.). However, research examining the effects of pre-entry attitudes and dispositions on actual turnover has been lacking. Researchers have suggested that pre-entry individual characteristics play a meaningful role in the subsequent development of organizational attachment (e.g. Lee *et al.*, 1992; Pierce & Dunham, 1987). Unlike prior turnover studies that have examined the effects of general individual difference variables such as Big Five personality factors and demographic characteristics (e.g. Lee *et al.*, 1992; Mael & Ashforth, 1995; Schuh, 1967), we focus on

more proximal, situation-specific, job-relevant characteristics that may have more meaningful implications for workplace behaviour.

Third, drawing on the argument that the effects of individual characteristics should be investigated by adopting a long-term perspective (Block, 1971), we employed a longer time frame than has been used in prior studies, thus increasing sensitivity in detecting potential influences of trait-like variables (Singer & Willett, 1991). Therefore, unlike most existing studies based on relatively short time intervals (typically, 1 or 2 years) between predictors and outcomes (e.g. Arnold & Feldman, 1982), the present study investigates long-term effects of pre-entry job-related individual characteristics on turnover, utilizing data collected over a 7-year period.

Finally, in pursuing the present research questions, we employed survival analysis, an analytic procedure designed to identify the hazard of an event such as turnover by taking into account both the occurrence of the event and the time until its occurrence. The duration of retention (time to departure or turnover in the present case) is critical in understanding employees' withdrawal behaviour (Kammeyer-Mueller *et al.*, 2005; Peters & Sheridan, 1988; Somers & Birnbaum, 1999; Steel, 2002). The inclusion of the duration of retention allows researchers to examine both *why* and *when* withdrawal occurs. For this reason, the outcome of this study represents *turnover hazard* that 'reflects not only the probability of turnover but also the expected speed of turnover' (Kammeyer-Mueller *et al.*, 2005, p. 645).

Method

Sample and data collection procedures

The present data were collected from 132 new recruits with doctoral degrees who were employed in an R&D division of a large electronics firm in Korea (a Fortune Global 100 company) that earns approximately 95% of its revenues overseas. This company was aggressively recruiting scientists and engineers with PhD degrees in order to strengthen its R&D capabilities. The current sample included all new recruits hired over a 2-year period. At the time of their entry into the organization, the average age of the individuals in this sample was about 37 years ($SD = 3.47$), ranging between 30 and 47, and seven participants (5.3%) were female. Eighty-three participants (63%) received their PhD degrees in the U.S., thirty-six (27%) in Korea, eight in Japan, four in Europe and one in Taiwan. Forty-eight participants (36%) majored in electrical/electronic/control engineering, twenty-four in materials science (18%) and the remainder in computer, mechanical or industrial engineering, or natural sciences including physics, chemistry and mathematics. Almost half of the participants (48%) had prior job experience of more than 6 months at either for-profit organizations or government-sponsored research institutes.

The data for the present study were gathered in two stages. In the first stage, we contacted the new hires after they negotiated and accepted the company's job offer, and administered a survey on the first day of a 2-week off-site orientation programme held before they started work. The survey data were collected from 132 new recruits who participated in 15 such orientation sessions conducted over a 2-year period. All participants were assured that their survey responses were confidential and would be used only for research purposes, and not be recorded in their personnel files. In the second stage, approximately 7 years after the first survey data collection, the data on the retention or turnover of the participants and the time they left the organization were collected from the personnel records of the company.

Measures

Innovative cognitive style

We used the Kirton Adaptor-Innovator scale (Kirton, 1976) to measure the participants' cognitive style. Numerous studies conducted in different countries with different populations (Chan, 1996; Kirton, 2003) have provided evidence of the construct validity, temporal stability and reliability (ranging between .76 and .91) of this scale. Research has shown that cognitive style as measured by KAI is distinct from cognitive ability and cognitive complexity (Kirton, 2003). This scale is composed of 32 items ($\alpha = .74$ in this study), each of which is rated on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). Example items included 'I would sooner create than improve' and 'I can stand out in disagreement against the group.' A low score indicates an adaptive style and a high score reflects an innovative style. A Korean version of this scale was developed through back translation procedures. We presented two versions (English and Korean) of the KAI scale to participants because many participants were more comfortable reading English than Korean.

Intrinsic and extrinsic work values

Before the present data collection, the first author interviewed thirty newly recruited R&D professionals with PhD degrees who were not part of the current sample. Through content analysis of the interview data, we identified 12 distinct work values of these professionals. This list of values substantially overlapped with the existing categories of work values developed for R&D professionals (Kochanski & Ledford, 2001; Miller, 1986). The 12 work values were transformed into scale items to measure the participants' work-related values at the time of their organizational entry. The *intrinsic work value scale* included the following seven items ($\alpha = .72$): (a) opportunities to learn new technology and knowledge; (b) the R&D project itself; (c) autonomy in performing tasks; (d) possibilities for expressing and realizing my full capability; (e) opportunities to achieve something valuable; (f) opportunities to participate in decision making and (g) participation in professional/academic conferences or seminars. *Extrinsic work values* were measured by the following five items ($\alpha = .70$): (a) salary; (b) fringe benefits (e.g. pension, insurance, paid leave); (c) social reputation of my job; (d) status at the laboratory or the company and (e) satisfaction of my family regarding my job. Respondents evaluated the extent to which having a job with each of these characteristics was important to them on a 5-point scale (1 = *not important*, 5 = *very important*). A confirmatory factor analysis indicated that the two-factor model ($\chi^2(df = 51) = 75.27$, $p > .01$; CFI = .92; RMSEA = .060) fit the data significantly better than the alternative single-factor model ($\chi^2(df = 52) = 125.74$, $p < .001$; CFI = .75; RMSEA = .104) as indicated by the significant difference between them ($\Delta\chi^2(\Delta df = 1) = 50.47$, $p < .001$). All items of these two work values significantly loaded on their corresponding latent factors (all $p < .001$).

Cosmopolitan career orientation

Adapting items from prior studies (Aryee & Leong, 1991; Gerpott *et al.*, 1988; Pelz & Andrews, 1976), we used a 7-item index to measure participants' career orientation. Of the seven items, three represented cosmopolitan orientation: (a) to make a contribution to the body of scientific and technological knowledge; (b) to publish papers with significant research findings and (c) to establish a reputation as an outstanding scientist or engineer.

The remaining four items measured local orientation: (a) to advance to upper levels of management; (b) to increase the profit of the company through research output; (c) to develop management skills and (d) to develop new commercially successful products for market. Participants were instructed to choose and rank the three top items according to degree of importance for their career. We assigned '3' to the first choice item, '2' to the second choice and '1' to the third choice. This ordinal scale based on ranking of the seven items was converted to an interval scale by transforming the ranking data into z-values based on the distance between each item in the overall rankings as rated by the participants (Hays, 1967). This procedure produced two career orientation scales that showed a perfect negative correlation due to the fact that choosing more local items automatically reduced the choice of cosmopolitan items. Of the two career orientation scales, the current analysis included the 3-item scale ($\alpha = .78$) of cosmopolitan orientation.

Turnover and retention time

Approximately 7 years after the initial data collection, we examined the company database and found that 83 of 132 survey participants (62.9%) had left the organization. The data from the remaining 57 participants were therefore referred to as *right censored*, meaning that measurement was discontinued prior to the occurrence of the event (turnover). The personnel records indicated that all turnover events were voluntary and caused by individuals' motivated choice (Campion, 1991). Given that the company was actively recruiting new PhDs to staff its expanding R&D centres, offered various incentives to retain them and provided a safe work environment, it was very unlikely that the participants experienced involuntary turnover (e.g. lay-off, injury). The record also showed that the majority of professionals who left did so to take a faculty position in academia. Turnover was a binary variable with two categories: 0 = 'stayed' and 1 = 'left'. The retention time for each participant was computed as the number of months that elapsed between entry and exit dates. Unlike logistic regression, which is based only on the status of the binary outcome, survival analysis utilizes both the binary outcome and retention time to calculate individuals' turnover hazard.

Control variables

Meta-analytic findings indicate that age has a moderate, negative correlation with turnover, perhaps due to its strong association with marital status and number of dependents (Griffeth *et al.*, 2000). Age may also prescribe appropriate career decisions for R&D professionals (Finegold *et al.*, 2002). In addition, we controlled for the effect of prior work experience. The transition from the academic environment to a business environment often induces cultural shock for fresh PhDs who have no previous work experience other than university research activities (Raelin, 1991), which might increase turnover. Prior work experience was measured by asking participants if they had worked for other organizations (0 = no previous work experience other than research experience at university or 1 = working in either non-profit research institutes or for-profit organizations). All participants who reported prior work experience indicated that they had worked for at least 6 months.

Analytic strategy

To test the present hypotheses, we employed the survival analysis methodology, which originates from biomedical statistics (Morita, Lee, & Mowday, 1993; Peters &

Sheridan, 1988). This analytic approach is useful in overcoming the problems of traditional approaches such as arbitrary classification of 'stayers' and 'leavers' based on measurement windows, and bias in parameter estimates stemming from right and left censored data (Peters & Sheridan, 1988). Researchers have increasingly considered the time-dependent nature of turnover by using survival analysis to predict not only whether someone will leave, but also *when* they will leave (Kammeyer-Mueller *et al.*, 2005). Survival analysis estimates the conditional probability of leaving, in which turnover is viewed as a time-dependent variable that changes based on how long one remains with an organization (Morita *et al.*, 1993). Due to its clear advantages, survival analysis has been increasingly adopted by turnover researchers (Iverson *et al.*, 2004; Mossholder *et al.*, 2005; Somers & Birnbaum, 1999).

Survival analysis methods include survival and hazard rate functions and proportional hazards regression models. The survival rate function indicates the portion of new employees who stay in the organization after reaching a particular month in their employment. The hazard rate function estimates the probability of employees leaving during a particular month, given that they have survived to the beginning of that month. Using survival analysis, we estimate a turnover hazard that reflects both the probability and the expected speed of turnover (Kammeyer-Mueller *et al.*, 2005). In this study, we used Cox regression analysis based on the proportional hazards function to test the effects of predictors (or covariates) on turnover. Cox regression is often referred to as a semi-parametric model because it does not need any *a priori* assumptions regarding the distribution of the event in the population (thus, nonparametric), but it is parametric in that it estimates regression coefficients based on the assumption that all hazard functions for the sample are proportional to a baseline hazard function (Morita *et al.*, 1993).

Results

Table 1 presents descriptive statistics and correlations among the variables examined. Participant age was positively related to prior work experience. Participants reported less cosmopolitan orientation with increasing age and prior work experience. Intrinsic and extrinsic work values were significantly and positively related to each other.

Table 1. Means, standard deviations and inter-scale correlations among study variables

Variables	M	SD	1	2	3	4	5	6	7
1. Age	38.20	3.47	–						
2. Prior work experience	0.48	0.50	.55***	–					
3. Innovative cognitive style	95.17	8.53	.02	.04	(.74)				
4. Intrinsic work values	4.28	0.45	–.08	–.11	.05	(.72)			
5. Extrinsic work values	3.87	0.54	.11	.02	.02	.21*	(.70)		
6. Cosmopolitan orientation	1.03	0.52	–.33***	–.31***	.07	.12	.02	(.78)	
7. Turnover	0.63	0.48	.19*	.08	.02	.22*	.03	.09	–

Note. Reliability coefficients of psychometric scales are shown in the diagonal in parentheses.

* $p < .05$; *** $p < .001$.

Survival analysis

The present hypotheses were tested by a proportional hazards survival analysis using Cox regression, in which turnover was regressed on the present set of control variables and predictors. As reported in Table 2, this regression equation provided a significant explanation of turnover hazard ($\chi^2(df = 6) = 13.64, p < .05$). The model explained a significant portion of the variance in the voluntary hazard rate (pseudo $R^2 = .10$). As shown in Table 2, the effects of age, prior work experience, KAI and extrinsic work values on turnover hazard were not significant (Hypotheses 1 and 3 not supported). As expected, intrinsic work values and cosmopolitan career orientation increased turnover hazard in the present sample of R&D professionals ($B = 0.79, p < .01$ and $B = 0.41, p < .05$, respectively). Thus, the data empirically confirmed Hypotheses 2 and 4.

Table 2. Survival regression analysis predicting employee turnover

Predictors	B	Standard error	exp(B)
Age	0.06	.04	1.07
Prior work experience	0.18	.27	0.83
Innovative cognitive style	-0.02	.01	0.98
Intrinsic work values	0.79**	.30	2.21
Extrinsic work values	-0.01	.21	0.99
Cosmopolitan orientation	0.41*	.23	1.51
Model χ^2	13.64*		
Pseudo R^2	0.10		

* $p < .05$; ** $p < .01$. One-tailed.

One of the main assumptions of the Cox proportional hazard model is proportionality - the ratio of hazards for any two observations is the same across time periods. This is a critical assumption of Cox regression and must be checked for each covariate. We checked the validity of the proportionality assumption by including time-dependent covariates in the model to test the interactions of the predictors and time (Hosmer & Lemeshow, 1999). The results showed that with the exception of the KAI \times time interaction term, none of the interaction terms were significant, thus supporting the assumption of proportional hazard. Although the effect of KAI fluctuated over time, we did not proceed with further corrective measures because KAI did not exhibit any significant main effect on turnover.

Comparison of hazard functions

The results in Table 2 indicate that R&D professionals with strong intrinsic work values and cosmopolitan career orientation were more likely to leave the organization. However, it is not clear how these two variables affected turnover over the 7-year period, during which the turnover event could occur at any time. To assess the possibility of time-dependent effects associated with these two significant predictors, we conducted separate survival analyses for two groups with high vs. low intrinsic work values and cosmopolitan vs. local orientation.

Figures 1 and 2 depict the distinct hazard functions over the 7-year period for two separate groups with different levels of intrinsic work values and career orientation, respectively. Figure 1 clearly shows that R&D professionals with high (above the median) intrinsic work values were more likely to leave. Additionally, the hazard rate for

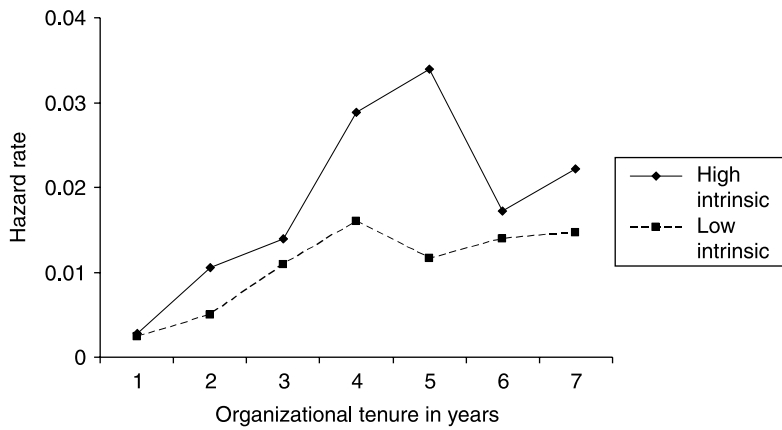


Figure 1. Comparison of hazard functions of R&D professionals with high and low intrinsic work values.

intrinsically driven R&D professionals was higher than that of their counterparts with low intrinsic work values. The difference between the two groups was particularly noticeable 4–5 years after organizational entry. In the case of career orientation, as shown in Figure 2, the risk of turnover for cosmopolitan-oriented R&D professionals increased almost linearly over the entire 7-year period. Local-oriented professionals showed a similar increase in the hazard rate over the first 4 years. From the fifth year of organizational entry on, however, the risk of turnover for locals started to decrease substantially, indicating that after some initial adjustment to the organization, local-oriented professionals tend to stay with it.

Discussion

With rapid technological developments and increasing global competition, recruitment and retention of talented R&D personnel is becoming a core managerial agenda in many

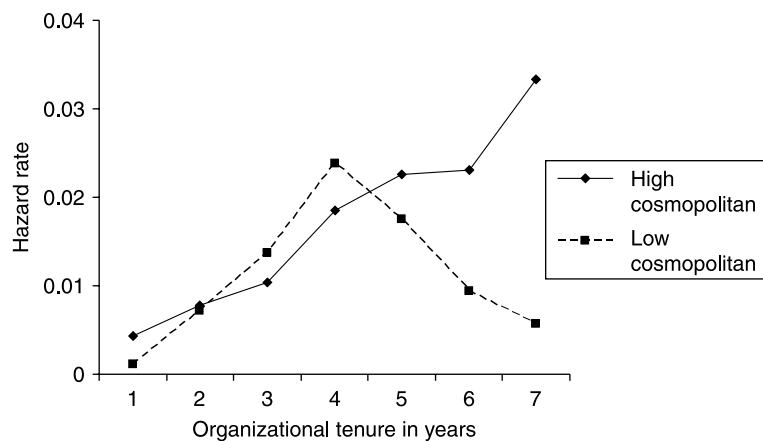


Figure 2. Comparison of hazard functions of R&D professionals with high and low cosmopolitan career orientation.

organizations, particularly in technology-based companies (Farris & Cordero, 2002; Kochanski & Ledford, 2001). Whereas successful R&D activities often rely on a small number of highly capable members (Michaels *et al.*, 2001), existing studies of R&D workers have for the most part been based on technicians or entry-level engineers who may not typically make a critical impact on the direction and outcomes of corporate R&D activities. The present study focused on R&D professionals with PhD degrees who play a central role in corporate R&D centres. Many high-tech companies strategically recruit in this category of individuals to reinforce their R&D muscle, and then pay special attention to them once they are hired in order to retain them (Lazar, 2001). Retention of this group of individuals is critical because they tend to occupy central positions in the organizational network, and the loss of social capital resulting from their turnover is substantial and difficult to replace in the short term (Amabile, 1988; Oh *et al.*, 2006). The present results suggest that individual characteristics such as work values and career orientation measured at the time of organizational entry have enduring effects on the probability of turnover of highly educated R&D professionals. This section highlights the key findings of this study and their implications, along with the study's potential limitations.

Theoretical implications

The present data showed that R&D professionals' cognitive style measured at the time of organizational entry was not significantly related to turnover. Nevertheless, prior studies indicate that cognitive style is a meaningful factor that determines the level of person-job fit for knowledge workers (Chan, 1996). It is possible that the present sample of highly educated R&D professionals had a good understanding of their cognitive style and pursued tasks and projects that they consequently felt comfortable with, thus ensuring some level of person-job fit from the beginning (Barrick & Zimmerman, 2005). Alternatively, it is possible that due to the relative homogeneity of the present sample and the data collected from a single organization, the association between cognitive style and turnover was not revealed, which presents a need for further theoretical and empirical efforts for identifying moderator variables (Allen *et al.*, 2005).

In the present sample, R&D professionals with high intrinsic work values were more likely to leave the organization, whereas extrinsic work values were not related to turnover. Intrinsic work values were also rated as more important than extrinsic work values by the study participants ($M = 4.28$ vs. 3.90 , respectively, $t = 8.34$, $p < .001$). The greater importance of work itself and its stronger impact on turnover of the R&D professionals in the present sample are consistent with previous findings. For example, a study involving 210 high-tech scientists and engineers showed that although their turnover decisions were affected by all five types of rewards (direct financial rewards, indirect financial rewards, career rewards, work content and affiliation), the majority of them chose personal satisfaction from work itself (work content) as the most important reason for turnover decisions (Kochanski & Ledford, 2001). Recently, Harpaz and Meshoulam (2004) also found that workers in high-tech companies tend to perceive work as a central part of their lives and take an expressive orientation towards work (e.g. sense of achievement) rather than an instrumental orientation (e.g. money). In the present corporate R&D setting, our interviews revealed that the R&D professionals were often frustrated because they did not have sufficient autonomy or opportunities to fulfil their intrinsic needs for learning and achievement.

Another individual characteristic that increased the risk of turnover of R&D professionals was a cosmopolitan career orientation. This pattern is consistent with a recent empirical finding based on a sample of school teachers (Iverson *et al.*, 2004). Relative to local-oriented professionals, cosmopolitan-oriented professionals tend to be less attached to their organization and adhere to high professional standards and expectations (Raelin, 1991; Larwood *et al.*, 1998). In the current sample of professionals with PhDs, those who left the organization may have done so to pursue professional goals that could not be fulfilled in the corporate R&D setting, such as academic research and building an individual reputation as a scholar. To achieve these professional goals, as indicated by an HR manager of the company, most of the professionals who left the R&D centres moved to institutions that allowed greater intellectual autonomy and opportunities to build an academic reputation (e.g. universities).

The hazard rate function shows that both locals and cosmopolitans experienced initial difficulties, perhaps due to new organizational demands and culture shock associated with the corporate R&D setting (Figure 2). Unlike cosmopolitans who exhibited an almost linear increase in their risk of turnover over the 7-year period, locals appeared to adjust to the organization about 4 years after their organizational entry. This differentiated pattern associated with the two groups of individuals clearly demonstrates the benefit of using longitudinal data collected over an extended period that tracks individuals from time of organizational entry (thus eliminating the risk of left-censored data).

Study limitations

Several limitations of this study should be noted. First, given that workers in high-tech companies are often oriented towards the intrinsic value of the work itself, and that electronics companies in particular experience greater pressure for innovation, the present findings might not apply to industries in which extrinsic values are more important and R&D efforts are carried out in a cautious manner within proven frameworks (Harpaz & Meshoulam, 2004). With regard to cross-cultural generalizability, Balkin and Gomez-Mejia (1984) found that professionals' work-related behaviours and attitudes were influenced to a greater extent by their profession than by societal culture. Gerpott *et al.*'s (1988) comparative study of R&D professionals also found more similarities than differences across nations. Considering that the majority of the present participants earned their PhDs in engineering or science in the U.S. or Europe, their professional attitudes and behaviour are likely not that different from those of Western professionals. Nevertheless, cross-industry and cross-cultural validation of the present findings would be an intriguing venue for future research.

Second, the fact that the present predictors are individual characteristics measured at the point of organizational entry (entry model) can be a potential limitation. As Kammeyer-Mueller *et al.* (2005) demonstrated, work-related attitudes and contextual perceptions change over time with significant organizational experience (within-individual shift), and the pattern of change over time, in addition to the initial level, predicts turnover hazard (dynamic model). Nonetheless, the present set of predictors tends to be relatively stable over time (Aryee & Leong, 1991; Kirton, 2003). Employees' disposition-like values and orientations may be important because they seek out or attend to salient information that is consistent with their values and attitudes. Future studies need to investigate the potential temporal changes of individual characteristics

during the process of organizational socialization (cf. Chang & Choi, 2007) and their interactions with contextual perceptions in predicting employees' turnover hazard over time.

Third, the present results were based on a relatively small number of professionals working in a single organization. In the case of survival analysis, in addition to sample size, much statistical power can be gained by following people for a longer period (Singer & Willett, 1991, p. 277). Given that the duration of collection of the outcome measure was relatively long in the present study, a sample size of 132 may not be a substantial threat to statistical power. Singer and Willett argued that the follow-up period should be long enough for at least half the sample to experience the target event over the two data collection points. This ensures sufficient information for estimating a median lifetime and offers reasonable statistical power. In the present study, 83 of 132 participants left the organization within the study period, providing sufficient statistical power for survival analysis. With regard to the use of a single organization, although the present research setting involved a multinational company with global operations, the results could be further validated by a multi-organizational investigation focusing on greater generalizability and the identification of potential organizational moderators.

Fourth, by instructing participants to rank-order career orientation items, cosmopolitan and local orientation scales were ipsative measures that may have some interpretive problems due to two reasons: (a) ipsative measures do not provide interval scales that are necessary for regression analysis and (b) scales created from a forced-choice procedure (in our case, cosmopolitan and local orientations) are not independent from each other, introducing a linear dependency among predictors (Pedhazur, 1982). Taking into account these problems, we transformed the rank-ordered scale of career orientations into interval scales (Hays, 1967). The interpretive problem of regression results due to linear dependence is caused only when we include two or more predictors developed from the same forced-choice procedure. For this reason, we included only one career-orientation measure instead of entering both measures into the equation, an analytic strategy that has been often used to avoid the inherent problems of ipsative measures (e.g. Jones, Jimmieson, & Griffiths, 2005).

Finally, the present measure of work values was not fully validated. Although the scale items of intrinsic and extrinsic work values identified for the present sample generally coincide with the existing measures and possess adequate psychometric properties, they are still subject to a rigorous validation procedure for clearly establishing their construct validity.

Practical implications and future research directions

Practically speaking, the present findings largely echo Barrick and Zimmerman's (2005) argument that organizations can reduce employee turnover by using biodata and individual difference variables that can be easily assessed during the process of recruitment and selection. Intrinsic motivation is beneficial to task performance due to its contribution to task effort, persistence and creativity (Amabile, 1988; Deci & Ryan, 1985). The present data, however, revealed that high intrinsic work values increase the risk of turnover for highly educated R&D professionals. In order to better retain highly educated R&D professionals, organizations could introduce new task processes and practices (e.g. entrepreneurship, internal ventures, self-managing teams) that offer greater opportunities to fulfil intrinsic goals. Specifically, organizations may need to introduce practices that will increase the fit between the person's needs/capabilities

and the organization's values/task demands (Chatman, 1991; Lee *et al.*, 2000). Since professionals are highly attached to their professional identity (Allen *et al.*, 2005; Chang & Choi, 2007), it is necessary to provide professionally valued rewards such as interesting research projects and sabbatical leaves, and to encourage professional activities such as attending conferences and publishing papers (Gomez-Mejia, Balkin, & Milkovich, 1990).

Similarly, strong cosmopolitan orientation based on commitment to and identification with their profession seemed to detach R&D professionals from the large corporation and increased the risk of turnover over time. Cosmopolitan orientation was more salient among younger professionals who did not have much prior work experience outside the university (see Table 1). Thus, it is critical to pay special attention to this group of individuals with high risk factors (young, fresh PhDs with strong commitment to their academic discipline) in order to retain valuable knowledge and social capital (Oh *et al.*, 2006). For instance, as Bartol (1979) suggested, the relationship between career orientation and turnover can be moderated by an organization's compensation and evaluation systems; if an organization supports and rewards professional activities, cosmopolitan orientation may not lead to turnover. In addition, it is plausible and desirable to slowly increase R&D professionals' local orientation by increasing their organizational commitment (Chang & Choi, 2007), perhaps by catering to their intrinsic values at work, which may lead to dual commitment to both the profession and the organization, thus reducing turnover (Iverson *et al.*, 2004).

Departing from the dominant focus of the turnover literature on job and organizational factors, this study has attended to stable individual characteristics of highly educated R&D professionals as predictors of turnover. By focusing on more situation-specific individual difference variables and adopting a long-term perspective, the present study demonstrated that intrinsic, but not extrinsic, work values have significant implications for actual turnover of R&D professionals. This pattern might indicate that for the present sample, extrinsic work values were adequately fulfilled by the organization, whereas this was not the case for intrinsic values. As Herzberg, Mausner, and Snyderman (1959) suggested, similar to the distinction between hygiene and motivating factors, extrinsic and intrinsic work values may initiate different cognitive processes, in which only intrinsic work values provoke psychological tension strong enough to induce turnover. Another possibility is that the present sample of highly educated professionals appreciate intrinsic values substantially more than extrinsic aspects of work and thus are far more sensitive to the fulfilment of their intrinsic work values. These alternative possibilities present a need to conduct further studies with different research designs involving multiple organizations and different occupational groups.

In addition to further investigating the main effects of individual differences on employee turnover, future studies could test the potential moderating roles played by these variables as measured at the time of organizational entry. For example, Allen *et al.* (2005) found that the link between turnover intention and actual turnover observed over a period of 1 year was stronger for employees with low self-monitoring and low risk aversion tendencies. However, a complete understanding of human behaviour (including turnover) can only be obtained when we examine both individual and contextual (situational) factors. Therefore, we gain a more sophisticated understanding of the processes underlying employee turnover when we investigate the ways in which individual characteristics and organizational contexts interact to generate intermediate

attitudinal outcomes (e.g. job satisfaction, commitment) as well as turnover. In this regard, the person–environment fit perspective may provide a valuable framework for future research, as it has in other areas of organizational behaviour (e.g. Chan, 1996). Finally, in addition to the use of an appropriate analytic strategy such as survival analysis for modelling turnover over time, it will be necessary to investigate turnover behaviour over an extended period of time using a sample of individuals who are in comparable career stages to identify career-related and tenure-dependent patterns of turnover.

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References

- Allen, D. G., Weeks, K. P., & Moffitt, K. R. (2005). Turnover intentions and voluntary turnover: The moderating roles of self-monitoring, locus of control, proactive personality, and risk aversion. *Journal of Applied Psychology, 90*, 980–990.
- Amabile, T. M. (1988). A model of creativity and innovation in organizations. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 10, pp. 123–167). Greenwich, CT: JAI Press.
- Arnold, H. J., & Feldman, D. C. (1982). A multivariate analysis of the determinants of job turnover. *Journal of Applied Psychology, 67*(3), 350–360.
- Aryee, S., & Leong, C. C. (1991). Career orientations and work outcomes among industrial R&D professionals. *Group and Organizations Studies, 16*, 193–205.
- Badawy, M. K. (1978). One more time: How to motivate your engineers. *IEEE Transactions on Engineering Management, EM-25*, 37–42.
- Balkin, D. B., & Gomez-Mejia, L. R. (1984). Determinants of R&D compensation strategy in the high tech industry. *Personnel Psychology, 37*, 635–650.
- Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: A meta-analysis. *Personnel Psychology, 44*, 1–26.
- Barrick, M. R., & Zimmerman, R. D. (2005). Reducing voluntary, avoidable turnover through selection. *Journal of Applied Psychology, 90*, 159–166.
- Bartol, K. M. (1979). Professionalism as a predictor of organizational commitment, role stress, and turnover: A multidimensional approach. *Academy of Management Journal, 22*, 815–821.
- Block, J. (1971). *Lives through time*. Berkeley, CA: Bancroft Books.
- Campion, M. A. (1991). Meaning and measurement of turnover: Comparison of alternative measures and recommendations for research. *Journal of Applied Psychology, 76*, 199–212.
- Chan, D. (1996). Cognitive misfit of problem-solving style at work: A facet of person-organization fit. *Organizational Behavior and Human Decision Processes, 68*, 194–207.
- Chang, J. Y., & Choi, J. N. (2007). The dynamic relationship between organizational and professional commitment of highly educated R&D professionals. *Journal of Social Psychology, 147*, 299–315.
- Chatman, J. A. (1991). Matching people and organizations: Selection and socialization in public accounting firms. *Administrative Science Quarterly, 36*, 459–484.
- Cohen, A. (1999). Turnover among professionals: A longitudinal study of American lawyers. *Human Resource Management, 38*, 61–75.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination theory in human behavior*. New York: Plenum Press.
- Farris, G. F., & Cordero, R. (2002). Leading your scientists and engineers 2002. *Research Technology Management, 45*, 13–25.

- Finegold, D., Mohrman, S., & Spreitzer, G. M. (2002). Age effects on the predictors of technical workers' commitment and willingness to turnover. *Journal of Organizational Behavior, 23*, 655-674.
- Gerpott, T. J., Domsch, M., & Keller, R. T. (1988). Career orientation in different countries and companies: An empirical investigation of West German, British and U.S. industrial R&D professionals. *Journal of Management Studies, 25*, 439-462.
- Gomez-Mejia, L. R., Balkin, D. B., & Milkovich, G. T. (1990). Rethinking rewards for technical employees. *Organizational Dynamics, 18*, 62-75.
- Gouldner, A. W. (1957). Cosmopolitans and locals: Toward an analysis of latent social roles-I. *Administrative Science Quarterly, 2*, 281-306.
- Griffeth, R. W., Hom, P. W., & Gaertner, S. (2000). A meta-analysis of antecedents and correlates of employee turnover: Update, moderator tests, and research implication for the next millennium. *Journal of Management, 26*, 463-488.
- Harpaz, I., & Meshoulam, I. (2004). Differences in the meaning of work in Israel: Workers in high-tech versus traditional work industries. *Journal of High Technology Management Research, 15*, 163-182.
- Hays, W. L. (1967). *Quantification in psychology*. Belmont, CA: Brooks/Cole.
- Hayward, G., & Everett, C. (1983). Adaptors and innovators: Data from the Kirton adaptation-innovation inventory in a local authority setting. *Journal of Occupational Psychology, 56*, 339-342.
- Herzberg, F., Mausner, B., & Snyderman, B. B. (1959). *The motivation to work*. New York: Wiley.
- Hom, P. W., & Griffeth, R. W. (1995). *Employee turnover*. Cincinnati, OH: South-Western.
- Hosmer, D. W., & Lemeshow, S. (1999). *Applied survival analysis*. New York: Wiley.
- Iverson, R. D., Mueller, C. W., & Price, J. L. (2004). Revisiting the cosmopolitan-local construct. An event history analysis of employee turnover. In R. Griffeth & P. Hom (Eds.), *Innovative theory and empirical research on employee turnover* (pp. 55-72). Greenwich, CT: Information Age Publishing.
- Jones, R. A., Jimmieson, N. L., & Griffiths, A. (2005). The impact of organizational culture and reshaping capabilities on change implementation success: The mediating role of readiness for change. *Journal of Management Studies, 42*, 361-386.
- Kammeyer-Mueller, J. D., Wanberg, C. R., Glomb, T. M., & Ahlburg, D. (2005). The role of temporal shifts in turnover processes: It's about time. *Journal of Applied Psychology, 90*, 644-658.
- Kerr, S., von Glinow, M. A., & Schriesheim, J. (1977). Issues in the study of professionals in organizations: The case of scientists and engineers. *Organizational Behavior and Human Performance, 18*, 329-345.
- Kirton, M. J. (1976). Adaptors and innovators: A description and measure. *Journal of Applied Psychology, 61*, 622-629.
- Kirton, M. J. (2003). *Adaptation-innovation: In the context of diversity and change*. New York: Routledge.
- Kochanski, J., & Ledford, G. (2001). How to keep me: Retaining technical professionals. *Research Technology Management, 44*, 31-38.
- Larwood, L., Wright, T. A., Desrochers, S., & Dahir, V. (1998). Extending latent role and psychological contract theories to predict intent to turnover and politics in business organizations. *Group and Organization Management, 23*, 100-123.
- Lazar, G. (2001). Keep your key people. *Electronic Business, 27*, 86-94.
- Lee, K., Carswell, J. J., & Allen, N. J. (2000). A meta-analytic review of occupational commitment: Relations with person- and work related variables. *Journal of Applied Psychology, 85*, 799-811.
- Lee, T. W., Ashford, S. J., Walsh, J. P., & Mowday, R. T. (1992). Commitment propensity, organizational commitment, and voluntary turnover: A longitudinal study of organizational entry processes. *Journal of Management, 18*, 15-32.
- Locke, E. A. (1976). The nature and causes of job satisfaction. In M. Dunnette (Ed.), *Handbook of industrial and organizational psychology* (pp. 1297-1349). Chicago: Rand McNally.

- Louis, M. R. (1980). Surprise and sense making: What newcomers experience in entering unfamiliar organizational setting. *Administrative Science Quarterly*, 25, 226-251.
- Mael, F. A., & Ashforth, B. E. (1995). Loyal from day one: Biodata, organizational identification, and turnover among newcomers. *Personnel Psychology*, 48, 309-333.
- Magnusson, D. (1988). *Individual development from an interactional perspective: A longitudinal study*. Hillsdale, NJ: Lawrence Erlbaum.
- Mathieu, J. E., & Zajac, D. M. (1990). A review and meta-analysis of the antecedents, correlates and consequences of organizational commitment. *Psychological Bulletin*, 108, 171-194.
- Michaels, E., Handfield-Jones, H., & Axelrod, B. (2001). *The war for talent*. Boston: Harvard Business School Press.
- Miller, D. B. (1986). *Managing professionals in research and development*. San Francisco, CA: Jossey-Bass Publishers.
- Morita, J. G., Lee, T. W., & Mowday, R. T. (1993). The regression-analog to survival analysis: A selected application to turnover research. *Academy of Management Journal*, 36, 1430-1464.
- Mossholder, K. W., Settoon, R. P., & Henagan, S. C. (2005). A relational perspective on turnover: Examining structural, attitudinal, and behavioral predictors. *Academy of Management Journal*, 48, 607-618.
- Oh, W., Choi, J. N., & Kim, K. (2006). Coauthorship dynamics and knowledge capital: The patterns of cross-disciplinary collaboration in information systems research. *Journal of Management Information Systems*, 22, 265-292.
- Pedhauzer, E. J. (1982). *Multiple regression in behavioral research: Explanation and prediction*. New York: Holt, Rinehart and Winston.
- Pelz, D. C., & Andrews, F. M. (1976). *Scientists in organizations: Productive climate for research and development*. Ann Arbor, MI: Institute for Social Research.
- Peters, L., & Sheridan, J. (1988). Turnover research methodology: A critique of traditional designs and a suggested survival model alternative. In K. M. Rowland & G. R. Ferris (Eds.), *Research in personnel and human resource management* (pp. 231-262). Greenwich, CT: JAI Press.
- Pierce, J. L., & Dunham, R. B. (1987). Organizational commitment: Pre-employment propensity and initial work experiences. *Journal of Management*, 13, 163-178.
- Raelin, J. A. (1991). *The clash of cultures: Managers managing professionals*. Boston: Harvard Business School Press.
- Rokeach, M. (1973). *The nature of human values*. New York: Free Press.
- Schuh, A. J. (1967). Application blank items and intelligence as predictors of turnover. *Personnel Psychology*, 20, 59-63.
- Scott, W. R. (1965). Reactions to supervision in a heteronomous professional organization. *Administrative Science Quarterly*, 10, 65-81.
- Singer, J. D., & Willett, J. B. (1991). Modeling the days of our lives: Using survival analysis when designing and analyzing longitudinal studies of duration and the timing of events. *Psychological Bulletin*, 110, 268-290.
- Somers, M. J., & Birnbaum, D. (1999). Survival versus traditional methodologies for studying employee turnover: Differences, divergences and directions for future research. *Journal of Organizational Behavior*, 20, 273-284.
- Steel, R. P. (2002). Turnover theory at the empirical interface: Problems of fit and function. *Academy of Management Journal*, 27, 346-360.
- von Glinow, M. (1988). *The new professional: Managing today's high-tech employees*. Cambridge, MA: Ballinger.
- Wallace, J. E. (1993). Professional and organizational commitment: Compatible or incompatible? *Journal of Vocational Behavior*, 42, 333-349.
- Wanous, J. P. (1992). *Organizational entry: Recruitment, selection, orientation, and socialization of newcomers*. Reading, MA: Addison Wesley.