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# SUSTAINABLE IT-SPECIFIC HUMAN CAPITAL: COPING WITH THE THREAT OF PROFESSIONAL OBSOLESCENCE

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# SUSTAINABLE IT-SPECIFIC HUMAN CAPITAL: COPING WITH THE THREAT OF PROFESSIONAL OBSOLESCENCE

*Completed Research Paper*

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## **Abstract**

*This study contributes to research examining how IT professionals cope with the threat of professional obsolescence. In answering this question, this study draws on theories of occupational stress, specifically the theory of conservation of resources (Hobfoll 2002; Hobfoll and Freedy 1993), to relate the threat of professional obsolescence with IT professionals' coping behaviors. This study extends the theory of conservation of resources in several directions such as theorizing and testing the job mobility intentions of turnover and turnaway as consequences; and by proposing organizational updating climate as a proximal contextual moderating factor. The results obtained from a large sample of IT professionals are both consistent with and contrary to theorized relationships. We also uncover several new findings pertaining to the role played by organization updating climate and its potential limit in supporting updating activities of IT professionals. We conclude this study with a discussion of the results and propose future research directions.*

**Keywords:** IT Professional Obsolescence, Organizational Updating Climate, Conservation of Resources, Sustainable IT-Specific Human Capital

## **Introduction**

The threat of professional obsolescence remains an enduring challenge for IT professionals. The threat of professional obsolescence is of concern for the IT profession because the half-life of IT-specific human capital is estimated at less than two years (Ang and Slaughter 2000; Dubin 1990). This rate of erosion of IT-specific human capital contrasts sharply with the rate of erosion of other non-IT occupational human capital, and remains an enduring issue (Dubin 1990; Schambach 1994; Tsai et al. 2007). With such short shelf life, an IT professional's stock of IT-specific human capital erodes quickly and comes under the continuous threat of professional obsolescence (Tsai et al. 2007).

Consequently, IT professionals must remain technologically current and continuously maintain and acquire IT-specific human capital to remain productive in the IT profession. If not, IT professionals face the prospect of eroding their IT-specific human capital and, subsequently, having their IT careers constrained in terms of employability, compensation and career development (Tsai et al. 2007). The implications of professional obsolescence on industry are also clear. Professional obsolescence impacts organizations in the quality of IT-specific human capital available in the external labor market. When IT professionals do not regularly keep up with the latest technologies, organizations seeking to invest in and implement the latest information technologies will find it hard to recruit and costly to retain valuable IT talent. Organizations may have to resort to outsourcing or even recruiting from international spot markets by offshoring IT jobs that require the latest information technologies.

Although IT research has long pointed to professional obsolescence as a critical issue (Lee et al. 1995; Nelson 1991), limited theoretical and empirical research has directly examined the threat of professional obsolescence, its etiology, structure, or consequences. Specifically, little research has empirically examined how IT professionals cope with the threat of professional obsolescence (Joseph et al. 2007; Tsai et al. 2007) or examined the outcomes of coping with such threats (Jex and Yankelevich 2008). Hence, we contribute to research by asking: how do IT professionals cope with the threat of obsolescence? We draw on and extend theories of occupational work stress (Hobfoll and Freedy 1993; Lazarus and Folkman 1984) to examine the relationships between the threat of professional obsolescence, coping, organization updating climate and job mobility intentions.

In doing so, this study makes several contributions to the IT discipline and the broader management literature. One, this study adds to a nascent body of literature on IT professional obsolescence (Joseph and Ang 2001; Rong and Grover 2009; Schambach 1994; Tsai et al. 2007) by empirically testing a model of IT professionals' coping with the threat of professional obsolescence. Two, this study contributes to the extant organizational behavior literature by extending theories of occupational work stress to examine job mobility intentions as a consequence of coping with the threat of professional obsolescence. Three, this study adds to IT literature by empirically testing the moderating role of organizational updating climate as a form of social support in the relationship between coping and job mobility intentions. Finally, this study answers Kozlowski and Farr (1988)'s call for research to examine the interaction between individual factors and perceived situational features when examining technical professionals' voluntary updating efforts.

## **Theoretical Foundation and Hypotheses Development**

### ***Coping with the Threat of Professional Obsolescence***

Professional obsolescence is defined as the erosion of professional competencies required for successful performance (e.g., Dubin 1990; Ferdinand 1966; Glass 2000). It is essential that IT professionals possess up-to-date IT-specific human capital, i.e. IT knowledge and experience, because it affects their employability, compensation and career development. Human capital theories (Becker 1975; Spence 1973) suggest that IT professionals with the current IT-specific human capital are more likely to obtain alternative jobs in a competitive external labor market. As firms bid in the external labor market for the most productive human capital, it is likely that IT professionals with up-to-date IT-specific human capital would be more sought after and be paid a premium (Mithas and Krishnan 2008).

Therefore, the erosion of IT-specific human capital constitutes a potential threat to IT professionals, i.e., the threat of not being up-to-date with the rapidly changing technology environment (Schambach 1994; Tsai et al. 2007). It has

been argued and shown that IT professionals perceive professional obsolescence as a threat (Joseph and Ang 2001; Tsai et al. 2007). As a threat, professional obsolescence is argued to be an occupational work stressor as IT professionals are constantly required to be up-to-date with the latest IT technologies (Tsai et al. 2007); failing which, IT professionals face constrained careers in the IT profession (Joseph et al. Forthcoming; Joseph et al. 2007).

To explain how IT professionals cope with the threat of professional obsolescence, we draw on the theory of conservation of resources (Hobfoll 2002; Hobfoll and Freedy 1993). The theory of conservation of resources proposes that individuals respond to threats by seeking to obtain, retain and protect their resources; and that stress occurs when resources are threatened with loss. Resources are defined as “those entities that are centrally valued in their own right (e.g., self-esteem, close attachments, health, and inner peace) or act as a means to obtain centrally valued ends (e.g., money, social support, and credit)” (Hobfoll 2002, p. 307). To obtain such resources, individuals expend cognitive, emotional and physical energies (Hobfoll and Freedy 1993). Within this theoretical framework, IT-specific human capital is viewed as a resource as it certainly acts as a means to obtain centrally valued ends such as employability (Joseph et al. Forthcoming) and compensation (Mithas and Krishnan 2008). Moreover, IT professionals expend cognitive, emotional and physical energies in learning new information technologies; in taking risks and making errors playing with these new technologies; and in applying these technologies to specific domains.

When faced with a loss of or threat to resources, theories of occupational stress are in agreement that there are two separate, but concurrent behavioral responses (Davey 1993; Folkman and Lazarus 1988; Jex and Yankelevich 2008). One, individuals may take direct action to “do something” to alter the threat by dealing directly with it (Davey 1993, p. 535). This approach is primarily task-oriented. In the IT context, IT professionals have been shown to directly update their IT-specific human capital in response to professional obsolescence (Glass 2000; Pazy 1990; Pazy 2004; Rong and Grover 2009). Direct updating involves updating one’s stock of human capital by undertaking assignments from which new IT-specific human capital may be obtained (O’Mahony and Bechky 2006).

Through direct updating, research indicates that IT professionals are able to update their IT-specific human capital in a rapidly changing technological environment (O’Mahony and Bechky 2006). Immediate outcomes of direct updating are state-of-the-art of knowledge, skills, and experiences (Pazy 2004; Tesluk and Jacobs 1998). Research also shows that direct updating typically leads to positive outcomes such as a reduction of stress (Herman and Tetrick 2009; Shiloh et al. 1997) and continued progression in the IT labor market (O’Mahony and Bechky 2006).

Together with direct updating, IT professionals may adopt a deferred updating approach (Pazy 1990; Pazy 1994). With deferred updating, IT professionals typically assume that the “burden of professional obsolescence is shared with others, (and) is potentially threat reducing” (Pazy 1994, p. 1179). Professionals may be comforted by the notion that they are not alone in experiencing professional obsolescence (Tsai et al. 2007) and hold an implicit belief “that nothing really bad can happen to the whole group” (Pazy 1994, p. 1179). Consequently, the pressure to personally update one’s IT-specific human capital becomes delegated to or shared with other IT professionals in the team or department (Pazy 1990; Pazy 1994).

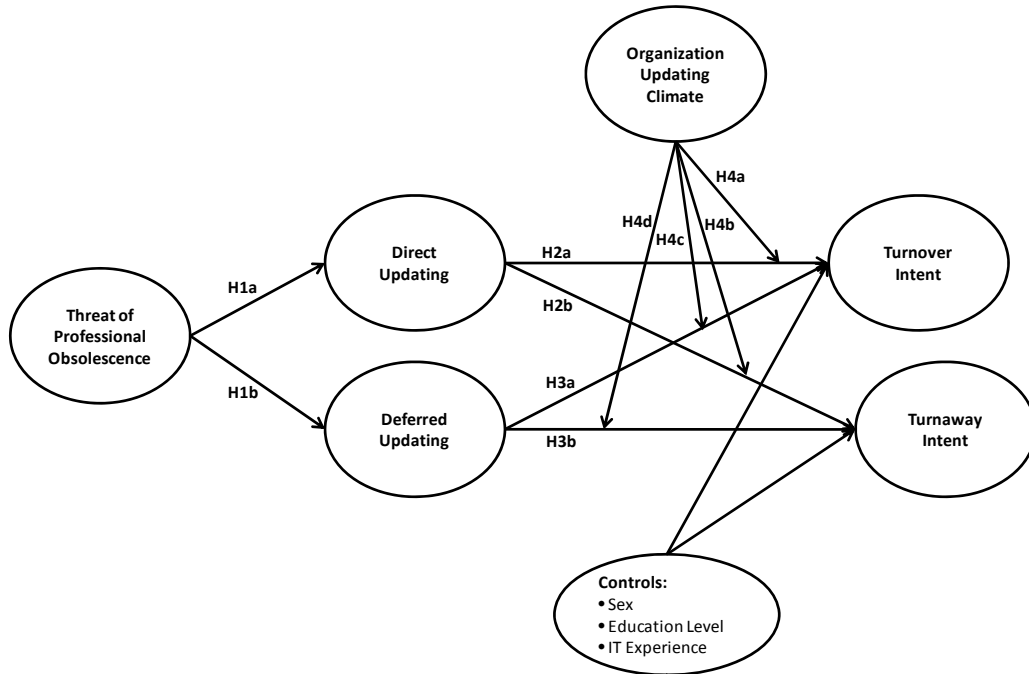
With deferred updating, professionals may hold that updating is necessary but it is less important that any one individual masters a new information technology. The responsibility of ensuring that at least one person in the work group keeps abreast with the latest technologies is typically delegated to supervisors (Pazy 1994). In essence, deferred updating sees resource loss as a collective problem, rather than as an individual problem; and that the collective should ensure that resources are obtained, retained and protected. Consequently, the lack of direct exposure, experience and practice results in individuals not having the opportunity to develop and refine their human capital (Tesluk and Jacobs 1998).

Applying the conservation of resources theory to the threat of IT professional obsolescence (Figure 1), we argue that professional obsolescence is a threat to IT professionals because it erodes IT-specific human capital held by IT professionals. In response, IT professionals cope via both direct and deferred updating. While both direct and deferred updating are adopted for resolving occupational stress (Dubin 1990; Kozlowski and Farr 1988; Pazy 2004; Tsai et al. 2007), we argue that IT professionals would likely respond to the threat of professional obsolescence through direct updating rather than by deferred updating. Direct updating may be preferred over deferred updating because “(direct) updating is the most direct way of coping with the (professional) obsolescence threat, as it literally reduces (subsequent professional) obsolescence” (Pazy 1996 p. 261). The assertion that direct updating is the most direct approach to obtain, retain and protect their resources, i.e. IT-specific human capital is consistent with the theory of conservation of resources.

Deferred updating is utilized when IT professionals assess that professional obsolescence is an unchangeable situation and “when they believe that nothing constructive can be done about the stressor and that the problem is something that they must endure” (Tsai et al. 2007 p. 403). Deferred updating, in contrast, does not directly address the threat to one’s human capital (Pazy 1994) because deferred updating leads to further erosion of IT professionals’ IT-specific human capital (Tsai et al. 2007). Deferred updating entrusts the responsibility of resource acquisition and facilitation to others and, realistically, no one in particular. In the IT context, IT professionals emphasizing deferred updating more than direct updating have been shown to respond to the threat of professional obsolescence by looking to others for updated IT-specific human capital (Pazy 1994) and by defeatism (Tsai et al. 2007). Hence,

*Hypothesis 1a: The threat of professional obsolescence is positively related to direct updating.*

*Hypothesis 1b: The threat of professional obsolescence is negatively related to deferred updating.*



**Figure 1. Research Model**

### ***Coping and Job Mobility Intentions***

There is limited research examining the job mobility consequences of direct updating and deferred updating (Kozlowski and Farr 1988; Steiner and Farr 1986). The available research suggests that direct updating, rather than deferred updating, is positively related to individuals’ performance ratings at work. However, research has yet to explore job mobility as a consequence of updating. Therefore, this study provides us the opportunity to contribute to the extant research on occupational work stress by linking updating behaviors to job mobility intentions. The job mobility intentions examined in this study are turnover intent, defined as an intention to hold the same or similar IT job in a different organization, and turnaway intent, defined as an intention of changing one’s profession from that of IT to another non-IT occupation (Joseph et al. Forthcoming).

In relating updating behaviors to job mobility, we begin by asserting that direct updating is positively related to turnover intentions but negatively related to turnaway intentions for several reasons. One, direct updating is aimed at maintaining IT professionals’ currency of IT-specific human capital. The extant research on IT job mobility concludes that IT professionals with higher levels of human capital are more likely to hold turnover intentions (Joseph et al. 2007) and are more likely to turnover (Joseph 2006) because these IT professionals have a wider range of job alternatives in the external labor market. Two, up-to-date IT-specific human capital facilitates turnover because such human capital is readily transferable to and directly contributes to IT professionals’ productivity in IT jobs in other firms. Three, IT professionals’ stock of up-to-date IT-specific human capital is of value to other

employers (Mithas and Krishnan 2008). These prospective employers are more likely to value up-to-date IT-specific human capital over less up-to-date IT-specific human capital. Job mobility studies based on human capital theories (e.g. Becker 1975; Spence 1973) show that firms pay a premium to entice the best available human capital from the external labor market (Joseph 2006; Mithas and Krishnan 2008).

Four, IT professionals sacrifice their direct updating efforts and investments in up-to-date IT-specific human capital when they turnaway. Up-to-date IT-specific human capital restricts job mobility to other occupations because such occupation specific capital is not readily transferable to or productively utilized in other occupations (Gathmann and Schonberg 2010). A recent study employing 30,000 individuals from the German Qualification and Career Survey showed that exits from an occupation declines with increasing levels of occupational human capital (Gathmann and Schonberg 2010). These ex-IT professionals who turnaway would be regarded as new entrants into their new occupation and would begin as inexperienced workers, regardless of human capital accumulated in other occupations (Kambourov and Manovskii 2009). Finally, the extant literature supports the proposition that occupation specific human capital entrenches or embeds individuals within an occupation (Ng and Feldman 2007) resulting in IT professionals intending to turnover rather to turnaway. Hence,

*Hypothesis 2a: Direct updating is positively related to turnover intentions.*

*Hypothesis 2b: Direct updating is negatively related to turnaway intentions.*

Given that deferred updating does not directly conserve IT professionals' IT-specific human capital, we would expect that the lack of up-to-date IT-specific human capital would narrow the range of job alternatives within the IT profession (Pazy 1996; Tsai et al. 2007). In a qualitative study of IT professionals' assessment of coping in the face of professional obsolescence, the professionals interviewed claimed that with higher professional obsolescence, "the range of job alternatives was likely to be reduced, and freedom of movement in the occupational world was likely to be limited" (Pazy 1996, p. 259). As such, we believe that deferred updating would be associated with lower intentions to turnover and higher intentions to turnaway.

IT professionals adopting deferred updating may seek to turnaway from the IT profession in response to the threat of professional obsolescence because the value of the IT-specific human capital has become depreciated. Turning away from the IT profession offers IT professionals with opportunities to continue to reap returns from their outdated IT-specific human capital as "power-users" in line functions. In fact, studies on IT professionals moving to line functions (Reich and Kaarst-Brown 1999; Reich and Kaarst-Brown 2003) find that these ex-IT professionals are valued for their tacit knowledge of business processes and understanding of the unique needs of the firm (Reich and Kaarst-Brown 1999; Reich and Kaarst-Brown 2003). In essence, IT professionals with outdated IT-specific human capital may be enticed to turnaway as firms seek to obtain competitive advantage from having a team of IT-trained professionals "with a long history with the firm and strong cross-divisional working relationships" (Reich and Kaarst-Brown 2003, p. 101). Finally, turning away may be a form of withdrawal as it reduces stress (Fugate et al. 2008) arising from subsequent professional obsolescence. This is especially so when turning away from the IT profession to other occupations with relatively more enduring knowledge bases and less influenced by technological changes (Ang and Slaughter 2000; Dubin 1990; Schambach 1994). Hence,

*Hypothesis 3a: Deferred updating is negatively related to turnover intentions.*

*Hypothesis 3b: Deferred updating is positively related to turnaway intentions.*

### ***Moderating Role of Organization Updating Climate***

IT research is in consensus that organization support in developing IT professionals' human capital plays a crucial role in retaining IT professionals within the organization (Ferratt et al. 2005; Joseph et al. 2007) and the IT profession (Joseph 2006). Accordingly, we propose organization updating climate as a proximal moderator influencing the relationship between updating and job mobility intentions. Organization updating climate represents individuals' socially influenced perception of technologies, management policies, supervisor practices, peer relationships and other salient work environment features (Kozlowski and Hulst 1987; Potosky and Ramakrishna 2002). It is conceptualized as a psychological climate where individuals interpret and assign meaning to the salient features in the organizational context (Wingreen and Blanton 2007). In essence, organization updating climate provides IT professionals with psychological support to acquire new and up-to-date IT-specific human capital (Schambach 1994).

While research on organizational updating climate has yet to examine its role in job mobility intentions, the literature in related domains, such as learning cognitions, provide insights on the theoretical linkages. The literature on learning cognitions shows that outcomes associated with learning cognitions may be tempered by situational cues (Potosky and Ramakrishna 2002). Organization updating climate, as a situational cue, motivates technical professionals towards behaviors congruent with human capital maintenance and acquisition (Kozlowski and Hults 1987). It follows, then, that the relationship between updating and job mobility intentions would be influenced when the organization climate supports updating.

With Hypothesis 2a above, we proposed that IT professionals with higher levels of direct updating would hold higher intentions to turnover because of the higher value of their IT-specific human capital in the external labor market. Yet, organizations might provide a positive climate for updating so as to retain these valuable IT professionals with up-to-date IT-specific human capital within the organization. A positive organization updating climate would be consistent with IT professionals' direct updating beliefs and efforts to conserve their IT-specific human capital (Wingreen and Blanton 2007). A positive organization updating climate would weaken the relationship between direct updating and turnover intentions by providing a supportive work environment within which IT professionals may further develop their skills. This supportive environment increases the costs and sacrifices employees must incur when they turnover (Ng and Feldman 2007).

The interaction of direct updating and organization updating climate would further strengthen the negative relationship with IT professionals' turnaway intent because organization updating climate reinforces updating of IT-specific human capital and increases the cost of exiting an occupation (Ng and Feldman 2007). Hence,

*Hypothesis 4a: The relationship between direct updating and turnover intent is moderated by organizational updating climate such that organization updating climate weakens the positive relationship between direct updating and turnover intent.*

*Hypothesis 4b: The relationship between direct updating and turnaway intent is moderated by organizational updating climate such that organization updating climate strengthens the negative relationship between direct updating and turnaway intent.*

A positive organization updating climate would strengthen the negative relationship between deferred updating and turnover intentions. It would do so because a positive organization updating climate motivates updating of IT-specific human capital in IT professionals who would otherwise delegate that responsibility to others. As such, a positive updating climate strengthens the relationship between deferred updating and turnover intentions by increasing the cost associated with exiting their current employer (Ng and Feldman 2007).

With Hypothesis 3b above, we proposed that IT professionals with higher levels of deferred updating would hold higher intentions to turnaway from the IT profession due to restricted IT job alternatives and as withdrawal from pressures to constantly update one's IT-specific human capital. Yet, organizations might provide a positive climate for updating so as to retain IT professionals, albeit with less current IT-specific human capital, within the profession. A positive organization updating climate would weaken the relationship between deferred updating and turnaway intentions by providing a supportive work environment within which IT professionals may further develop their skills. By investing in and conserving their IT-specific human capital, IT professionals increase the cost and sacrifice required to exit from the IT profession (Joseph 2006). Hence,

*Hypothesis 4c: The relationship between deferred updating and turnover intent is moderated by organizational updating climate such that organization updating climate strengthens the negative relationship between deferred updating and turnover intent.*

*Hypothesis 4d: The relationship between deferred updating and turnaway intent is moderated by organizational updating climate such that organization updating climate weakens the positive relationship between deferred updating and turnaway intent.*

## Method

### *Data Collection*

Data for this study was gathered via a web-based survey. Email invitations were sent to members of a national IT association, the Singapore Computer Society, inviting them to participate in the study. A total of 1,449 IT professionals completed the survey, representing a response rate of about 24.15%, based on total membership figures provided by the Singapore Computer Society.

### *Sample*

The median age of respondents in this study was between 31 to 35 years old with an average working experience of 12.83 years ( $SD = 8.62$  years). Their average organization tenure was 6.02 years ( $SD = 6.50$  years). The sample comprised of 71.70% males and 28.30% females. Of the 1,449 IT professionals in the sample, 81.44% attained at least a bachelor's degree and the remaining 18.56% possessed less than a bachelor's degree. The IT professionals surveyed held job roles in both IT management (e.g. chief information officers, applications development managers and project managers), systems development (e.g. systems analyst, and programmers) as well as IT infrastructure (e.g. data center operatives, network administrators, and database administrators).

### *Measures*

The questionnaire completed by the respondents contained multiple measurement items relating to each of the constructs in the research model. Wherever possible, we used scales validated in previous studies. For the remaining constructs, we used sets of items generated based on reviews of prior relevant literature. For all items, respondents were asked to indicate the extent to which they agreed or disagreed with the statements on a seven-point Likert-type scale, anchored by "1" = "Strongly disagree" and "7" = "Strongly agree."

The dependent variables of *Turnover Intent* and *Turnaway Intent* were measured with three items each adapted from Rusbult et al. (1988). Examples of items measuring *Turnover Intent* include: "I have recently spent some time looking for another ICT job" and "I am thinking about quitting from my current job for an alternative ICT job." Examples of items measuring *Turnaway Intent* include: "I have recently spent some time looking for a **non-ICT** job" and "I am thinking about quitting from my current job for an alternative **non-ICT** job."

The independent variables in the model are *Threat of Professional Obsolescence*, *Direction Updating* and *Deferred Updating*. The *Threat of Professional Obsolescence* was measured with two items based on research by Pazy (1990; 1994; 1996). The items measuring this construct are: "I perceive professional obsolescence to be a threat" and "I may lose a great deal if I become professionally obsolete."

We developed the five items of *Direct Updating* from O'Mahony and Bechky (2006)'s seminal paper on the stretchwork of IT professionals. Examples of items measuring this construct include: "I actively seek out assignments that not only draw on my current ICT skills and experiences, but also extend my ICT skills in a new direction" and "I actively seek out assignments that not only draw on my current ICT skills and experiences, but also help me acquire new ICT skills that are highly valued." Items for *Deferred Updating* were developed from Pazy's (1990; 1994; 1996) qualitative study on cognitive coping schemata of professional obsolescence. Examples of the three items measuring this construct include: "I look to others to keep updated with new ICT developments: and "I leave the task of updating ICT skills and knowledge to others in my project team."

The four items for the moderating variable, *Organization Updating Climate*, were adapted from Kozlowski and Hults (1987). Examples of items measuring this construct are: "My organization encourages the use of work-time for updating professional skills" and "My organization maintains subscriptions to ICT professional and trade journals".

The covariates in the model were *Sex*, *Educational Level* and *Work Experience* as these factors are shown to also explain job mobility intentions {Joseph, 2006 #104; Joseph, 2007 #77}. *Sex* was measured with a dichotomous variable indicate Male as "0" and Female as "1". *Educational Level* was measured with a polytomous ordinal variable with "1" indicating High School Diploma, "2" indicating Associate degree, "3" indicating Bachelors degree



and “4” indicating Postgraduate Degree. Finally, *IT Experience* was measured with a continuous variable indicating the total IT work experience held by an individual.

**Data Analysis**

We use partial least squares (PLS) to analyze the measurement and structural models. PLS is suited for this study because it combines principal component analysis, path analysis, and regression to simultaneously evaluate theory and data (Chin 1998; Hulland 1999). Data analysis with PLS begins with the assessment of the measurement model followed by the assessment of the structural model. In assessing the measurement model, we examine the construct validity in terms of convergent and discriminant validities. The structural model is evaluated by examining the predictive and explanatory powers of the model (Gefen et al. 2000). Finally, a bootstrapping test was conducted to compute estimates of standard errors for testing the statistical significance of path coefficients using t-tests.

**Results**

**Measurement Model**

The acceptability of the measurement model is assessed by internal consistency between items and the model’s convergent and discriminant validity. The composite reliability values of all constructs were above 0.900, indicating high internal consistency (Bagozzi and Yi 1988). Convergent and discriminant validities are assessed with the following criteria: (1) the square root of the average variance extracted (AVE) by a construct from its indicators should be at least 0.707, i.e. AVE itself should be greater than 0.5; (2) The square root of the AVE should be greater than the variance shared between the construct and other constructs in the model; and (3) standardized item loadings should be greater than 0.70 (Fornell and Larcker 1981). As shown in Table 1 and 2, convergent and discriminant validity was confirmed. The square root of AVE for each construct was greater than 0.707; all constructs shared more variance with their own indicators than with those of other constructs; and all the items loaded highly, based on established guidelines, and were statistically significant at the 0.001 level.

**Analysis of the Structural Model**

Figure 2 presents the results of the hypothesized structural model. The results in Figure 2, i.e. the path coefficients, from a PLS structural model, are interpreted as standardized betas. In addition, the predictive strength of a hypothesized model can be assessed with its total explained variance. The model explained 13.53% of the total variance in turnover intentions and 12.98% of the total variance in turnaway intentions. In turn, the threat of professional obsolescence explained 3.07% of the total variance in direct updating and 0.56% of the total variance in deferred updating.

	Mean	SD	N Items	CR <sup>1</sup>	AVE <sup>2</sup>	1 <sup>3</sup>	2	3	4	5	6	7	8
1 Turnover Intent	3.590	1.589	3	0.955	0.876	<b>0.936</b>							
2 Turnaway Intent	3.237	1.550	3	0.957	0.880	0.416 ***	<b>0.938</b>						
3 Threat of Professional Obsolescence	5.371	1.216	2	0.921	0.853	0.068 **	-0.030	<b>0.924</b>					
4 Direct Updating	5.150	1.056	5	0.975	0.886	0.158 ***	-0.145 ***	0.174 ***	<b>0.941</b>				
5 Deferred Updating	3.746	1.120	3	0.859	0.675	0.105 ***	0.253 ***	-0.062 *	-0.086 ***	<b>0.822</b>			
6 Organization Updating Cimata	4.569	1.216	4	0.895	0.680	-0.218 ***	-0.109 ***	0.061 *	0.115 ***	0.139 ***	<b>0.825</b>		
7 Sex	1.280	0.451	1			-0.109 ***	0.106 ***	-0.050	-0.176 ***	0.061 *	-0.002		
8 Education Level	3.051	0.843	1			-0.026	-0.156 ***	0.135 ***	0.091 ***	-0.079 **	-0.034	-0.118 ***	
9 IT Experience	10.890	7.954	1			-0.131 ***	-0.130 ***	0.085 ***	0.007	-0.045	0.007	0.002	0.295 ***

<sup>1</sup> Composite Reliability; <sup>2</sup> Average Variance Explained; <sup>3</sup> Emboldened numbers on the diagonal are the square root of AVE; off-diagonal elements are correlations among constructs.

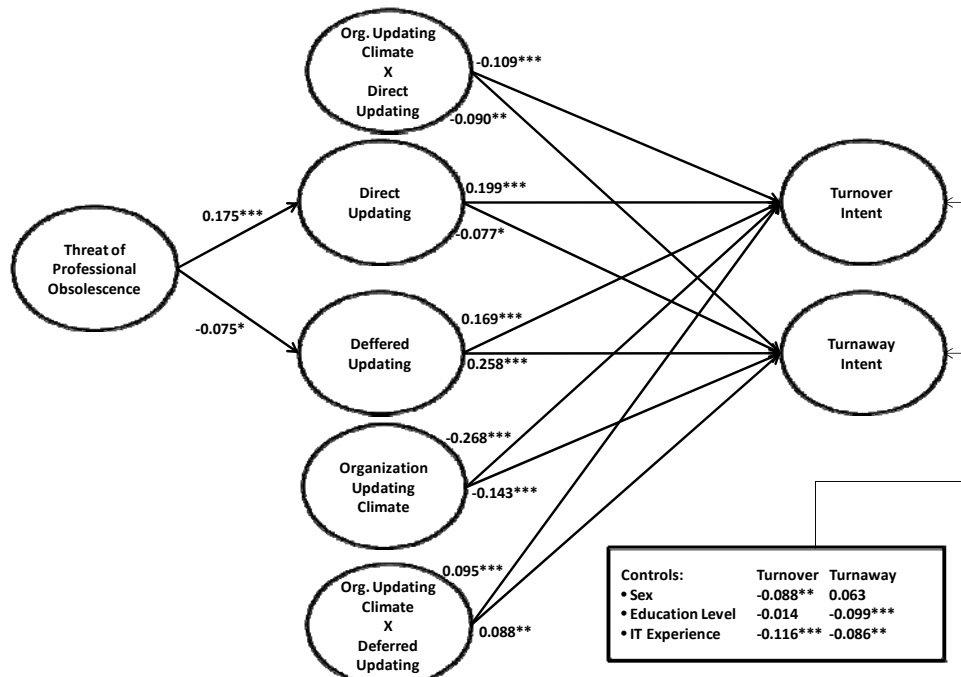
\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

**Table 1. Descriptives, Inter-construct Correlations and Results of Convergent and Discriminant Validities**

Construct	Item	Loadings	t - statistic
Turnover Intent	TOIntent1	0.915	137.634
	TOIntent2	0.955	218.317
	TOIntent3	0.938	122.600
Turnaway Intent	TAIntent1	0.913	118.865
	TAIntent2	0.961	314.572
	TAIntent3	0.940	146.063
Threat of Professional Obsolescence	ProObs1	0.915	57.040
	ProObs2	0.932	98.920
Direct Updating	NewComp1	0.912	69.691
	NewComp2	0.951	188.821
	NewComp3	0.942	146.858
	NewComp4	0.955	282.355
	NewComp5	0.948	174.909
Deferred Updating	Maintain	0.620	12.343
	Maintain	0.896	56.470
	Maintain	0.916	105.344
Organization Updating Climate	DevHR1	0.851	62.084
	DevHR2	0.829	54.092
	DevHR3	0.803	37.246
	DevHR4	0.816	46.742

All t-statistics are significant at  $p < 0.001$ .

**Table 2. Item Loadings and t-statistics**



\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

**Figure 2. Results**

### ***Threat of Professional Obsolescence and the Consequent Coping Cognitions***

Hypothesis 1a posited that the threat of professional obsolescence is positively related to direct updating. Supportive of Hypothesis 1b, we find that the threat of professional obsolescence is positively related to direct updating ( $\beta = 0.175, t = 5.416, p < 0.001$ ). The results indicate that a standard deviation increase in the threat of professional obsolescence results in a 17.5% increase in direct updating.

Hypothesis 1b posited that the threat of professional obsolescence is negatively related to deferred updating. Supportive of this hypothesis, the threat of professional obsolescence is negatively related to deferred updating ( $\beta = -0.075, t = 2.484, p < 0.01$ ). This result indicates that a standard deviation increase in the threat of professional obsolescence results in a 7.5% increase in deferred updating.

### ***Coping Strategies and its Consequent Job Mobility Intentions***

Hypothesis 2a posited that direct updating is positively related to turnover intentions. Supportive of this hypothesis, we find that direct updating is positively related to turnover intent ( $\beta = 0.199, t = 7.011, p < 0.001$ ). This result indicates that a standard deviation increase in direct updating results in a 19.9% increase in turnover intention.

Hypothesis 2b posited that direct updating is negatively related to turnaway intentions. Supportive of this hypothesis, we find that direct updating is negatively related to turnaway intent ( $\beta = -0.077, t = 2.702, p < 0.01$ ). This result indicates that a standard deviation increase in direct updating results in a 7.7% decrease in turnover intention.

Hypothesis 3a posited that deferred updating is negatively related to turnover intentions. Contrary to expectations, we find that deferred updating is positively related to turnover intent ( $\beta = 0.169, t = 6.581, p < 0.001$ ). This result indicates that a standard deviation increase in deferred updating increases turnover intent by 16.9%.

Hypothesis 3b proposed that deferred updating is positively related to turnaway intentions. Supportive of this hypothesis, we find that deferred updating is positively related to turnaway intent ( $\beta = 0.258, t = 8.572, p < 0.001$ ). This result indicates that a standard deviation increase in deferred updating increases turnaway intent by 25.8%.

### ***Moderating Role of Organization Updating Climate***

Consistent with theory and prior research, we find that perceived organization updating climate is negatively related to both turnover intent ( $\beta = -0.268, t = 9.919, p < 0.001$ ) and turnaway intent ( $\beta = -0.143, t = 4.637, p < 0.001$ ). The results indicate that a standard deviation increase in perceived organization updating climate reduces IT professionals' turnover intent by 26.8% and turnaway intent by 14.3%.

To better understand the results of the interactions, we graphed the results of the interactional analysis following procedures recommended by Aiken and West (1991). Specifically, we conducted a median split along the dimensions of coping and organization updating climate. We then graphed (Figure 3) the mean values of turnover intent and turnaway intent for high and low values of the variables involved in the interaction.

Hypotheses 4a concerns the moderating role of organization updating climate in the relationship between direct updating and turnover intentions. Supportive of Hypothesis 4a, we find that organization updating climate weakened the positive relationship between direct updating and turnover intent ( $\beta = -0.109, t = 3.736, p < 0.001$ ). In Panel A of Figure 3, we see that the positive relationship between direct updating and turnover intent weakens for IT professionals in organizations with higher levels of organization updating climate.

Hypothesis 4b concerns the moderating role of organization updating climate in the relationship between direct updating and turnaway intent. Supportive of Hypothesis 4b, we find that organization updating climate strengthened the negative relationship between direct updating and turnaway intent ( $\beta = -0.090, t = 2.512, p < 0.01$ ). In Panel B, we see that the negative relationship between direct updating and turnaway intent is further strengthened in organizations with higher levels of organization updating climate.

Hypotheses 4c concerns the moderating role of organization updating climate in the relationship between deferred updating and turnover intentions. Although the underlying relationship between deferred updating and turnover intentions was contrary to our hypothesis (Hypothesis 3a), we find that this relationship is weaker for higher levels

of organization updating climate ( $\beta = 0.095$ ,  $t = 3.734$ ,  $p < 0.001$ ; Panel C). This finding remains consistent with our thesis that higher levels of organization updating climate facilitates the retention of IT professionals with higher levels of deferred updating.

Hypothesis 4d concerns the moderating role of organization updating climate in the relationship between deferred updating and turnaway intentions. Supportive of Hypothesis 4d, we find that organization updating climate weakened the positive relationship between deferred updating and turnaway intent ( $\beta = 0.088$ ,  $t = 2.668$ ,  $p < 0.01$ ). In Panel D, we see that the relationship between deferred updating and turnaway intent is weaker in organizations with higher levels of organization updating climate.

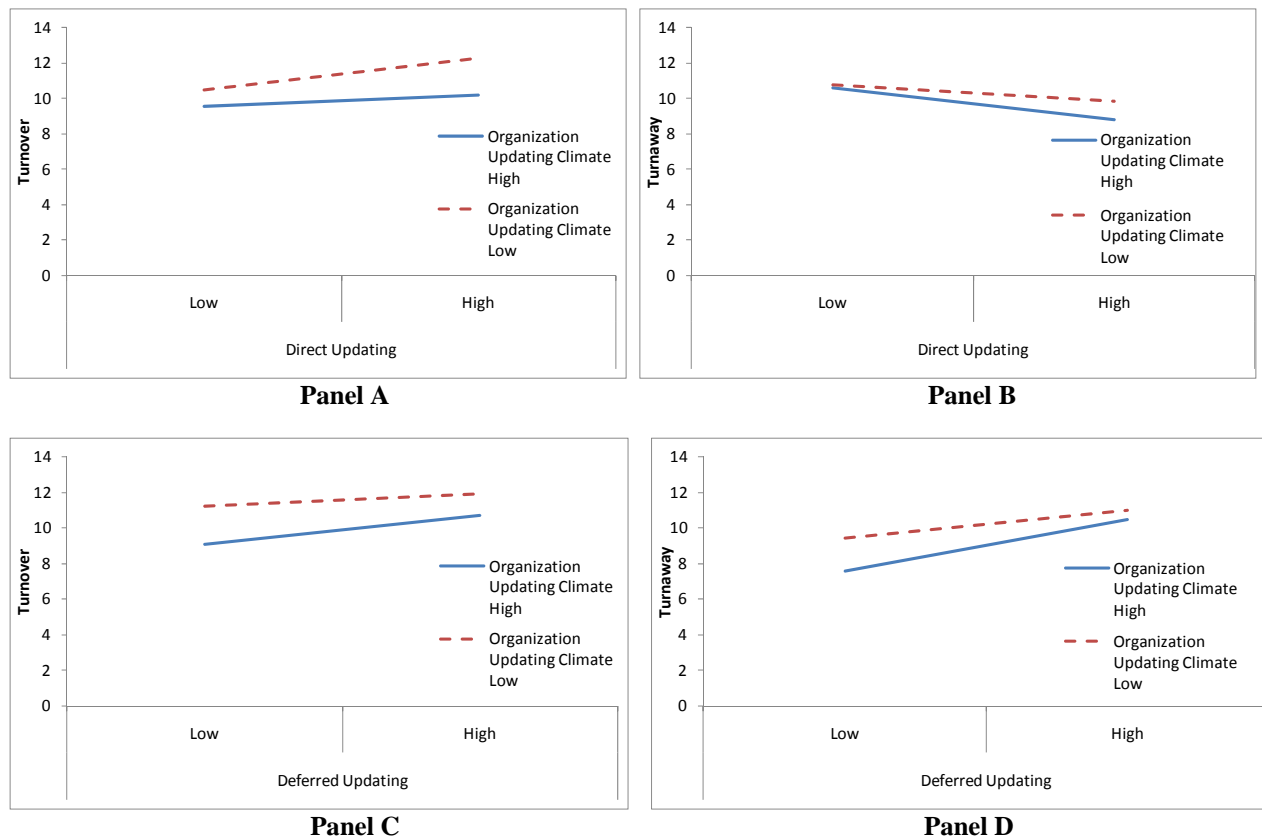


Figure 3. Results of the Moderating Role of Organization Updating Climate

## Discussion

We undertook this study to examine the broad research question of how IT professionals cope with the threat of professional obsolescence. In doing so, this study contributes to the IT discipline and the broader management literature in several important ways. One, this study adds to the nascent body of IT literature (Joseph and Ang 2001; Rong and Grover 2009; Schambach 1994; Tsai et al. 2007) to empirically test a model of how IT professionals cope with the threat of professional obsolescence. Prior research (e.g. Rong and Grover 2009; Schambach 1994; Tsai et al. 2007) has always assumed that IT professionals are under the threat of professional obsolescence and that updating behaviors are an outcome of this threat. The empirical linkage between perceived threat of professional obsolescence and coping (or to any other outcome) has not been tested to date. Two, this study answers the call to push the boundaries of occupational stress research to examine the outcomes of coping (Jex and Yankelevich 2008). As such, this study contributes to the extant organizational behavior literature by extending theories of occupational work stress to examine job mobility intentions as consequent to coping with the threat of professional obsolescence.

Three, this study adds to the nascent body of IT literature to empirically test the moderating role of organizational updating climate as a form of social support in the relationship between coping and job mobility intentions. Finally,

this study answers Kozlowski and Farr (1988)'s call for research to examine the interaction between individual factors and perceived situational features when examining technical professionals' voluntary updating efforts. Answering this call, we contribute to the IT and management literature by extending the theory of conservation of resources (Hobfoll 2002; Hobfoll and Freedy 1993) by including the role of situational cues in this theory (Hobfoll 2002).

This study finds that IT professionals do indeed perceive the threat of professional obsolescence. In response to this threat, IT professionals are more likely to cope through direct updating rather than deferred updating. Direct coping is positively associated with turnover intentions and negatively associated with turnaway intentions. These findings are consistent with the theories of conservation of resources (Hobfoll 2002; Hobfoll 1989) and of human capital (Becker 1975; Gathmann and Schonberg 2010; Joseph 2006; Kambourov and Manovskii 2009; Mithas and Krishnan 2008). The theory of conservation of resources proposes that individuals will seek to protect their resources when these resources are threatened by professional obsolescence. With protected IT-specific human capital, IT professionals find that their human capital is of value to firms in the external labor market and that these prospective employers are likely to pay a premium for their IT-specific human capital. IT professionals with up-to-date IT-specific human capital, therefore, may hold higher intentions to turnover to avail themselves of this pay premium. IT professionals, in turn, are less likely to turnaway because turning away to a non-IT occupation diminishes the value of their stock of human capital in a similar manner as professional obsolescence.

Contrary to our hypothesis, we find that deferred updating is positively related to turnover intentions. A proposition for this counterintuitive finding is that IT professionals who enact deferred updating may be intending to withdraw from a stress inducing environment (Herman and Tetrick 2009) towards a less stressful work environment where the technology requirements may be less arduous on these IT professionals. As the job destination of IT professionals' in this study are beyond its scope, we call for future research to examine the thesis that withdrawal to environments with less current IT is a form of coping. Deferred updating, on the other hand, does little to protect one's stock of IT-specific human capital. In fact, deferring updating to others exposes one's stock of human capital to further erosion (Pazy 1994; Pazy and Goussinsky 1995; Tsai et al. 2007). Expectedly, we find that IT professionals seriously evaluating the possibility of leaving the IT profession.

To retain these up-to-date IT professionals within the firm and profession, a positive organization updating climate significantly tempers the relationships between the two forms of updating and job mobility intentions. Organizations in which IT professional perceive high levels of updating support consistently report lower levels of job mobility irrespective of the type of updating. When IT professionals are willing to update and when organizations support such updating activities, we find that IT professionals will tend to be attached to their current employers than to seek alternative employment. Similarly, IT professionals are less inclined to leave the IT profession when they are willing to update and when their employer supports such updating effort. In essence, the combination of direct updating and a positive organization updating climate provides little motivation to turnover. The practical implication of this finding is clear – organizations should consider supporting the professional updating of their IT professionals or risk losing their IT professionals to other organizations or professions.

Yet, we find that organization updating climate appears more effective in lowering intentions to turnover and turnaway for IT professionals enacting low, but not higher levels of deferred updating. It could be that these IT professionals, through deferred updating, have successfully redefined the threat to themselves such that all support provided by the organization is ignored or underutilized (Kinicki et al. 2000). Although deferred updating may be adaptive in reducing the stress brought about by the threat of professional obsolescence (Tsai et al. 2007), the results suggest that it may be a misguided approach; one that ignores available organizational support and the continued erosion of their IT human capital. As noted above, deferred updating tends to be strongly associated with cognitions of withdrawal from organization and the IT profession. Future research should shed light on the profile of IT professionals choosing to cope with the threat of professional obsolescence via deferred updating and to seek other moderators (e.g. gender or tenure) that may help IT professionals avail themselves of organizational support when deferred updating is high. Such a study would contribute to the IT discipline and to the practice of IT in IT-specific human capital development.

Finally, the above results also support arguments for the primacy of individual cognitions over situational cues in the job mobility intentions of IT professionals (see Figure 3 of Joseph et al. 2007, p. 563). Accordingly, another line of inquiry could be to examine whether there are differential individual level outcomes with varying magnitudes of threat of professional obsolescence (Pazy 1990). As noted by Pazy, if the threat is too high, IT professionals may escape, withdraw or adopt rigid responses. One possible withdrawal or escape route could be turnaway. If the threat

is too low, it may have a numbing effect on IT professionals who are unlikely to be motivated to update their IT-specific human capital. Thus, future research could adopt an experimental approach to study the relationship between the magnitudes of threat and their consequences.

## Conclusion

In conclusion, this study examines a critical issue confronting IT professionals – the threat of professional obsolescence. As there is limited theoretical and empirical research in the IT discipline that has directly examined the threat of professional obsolescence, its etiology, structure, or consequences, we heed the call made by prior research to examine how IT professionals cope with this threat of professional obsolescence (Pazy 1990; Tsai et al. 2007) and examine the outcomes of coping with such threats (Jex and Yankelevich 2008). In doing so, this study establishes the basic tenets of the theories employed and also raises interesting directions for future research.

This study also has clear implications for IT practice. This study finds strong support for the direct and indirect role of organizational updating climate in the retention of IT professionals within the organization and the profession. Yet, the effectiveness of organization updating climate reaches its boundary with IT professionals enacting higher levels of deferred updating. It appears that IT professionals who prefer deferred updating to direct updating find their IT-specific human capital eroded to the point that they no longer fit with the organization or the profession. If that is true, then the organization not only loses IT human capital but also firm specific human capital that is more expensive to replace. Perhaps, organizations may facilitate the transition of such IT professionals to “power-user” type roles. Such transitions protect firms’ investments in human capital by retaining relatively more valuable business and firm related knowledge rather than out-dated IT-specific human capital. In other words, firms retaining and moving these IT professionals to line functions might obtain competitive advantages arising from having a team of IT-trained professionals “with a long history with the firm and strong cross-divisional working relationships” (Reich and Kaarst-Brown 2003, p. 101).

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## References

- Aiken, L.S., and West, S.G. 1991. *Multiple Regression: Testing and Interpreting Interactions*. Newbury Park, California: Sage Publications.
- Ang, S., and Slaughter, S. 2000. "The Missing Context of Information Technology Personnel: A Review and Future Directions for Research," in: *Framing the Domains of IT Management: Projecting the Future through the Past*, R.W. Zmud (ed.). Cincinnati, Ohio: Pinnaflex Educational Resources, pp. 305-327.
- Bagozzi, R.P., and Yi, Y. 1988. "On the Evaluation of Structural Equation Models," *Journal of the Academy of Marketing Science* (16:1 (Spring)), pp. 74-94.
- Becker, G. 1975. *Human Capital*. University of Chicago Press.
- Chin, W.W. 1998. "Issues and Opinion on Structural Equation Modeling," *MIS Quarterly* (22:1), March, pp. VII-XVI.
- Davey, G.C.L. 1993. "A Comparison of 3 Cognitive Appraisal Strategies - the Role of Threat Devaluation in Problem-Focused Coping," *Personality and Individual Differences* (14:4), April, pp. 535-546.
- Dubin, S.S. 1990. "Maintaining Competence through Updating," in: *Maintaining Professional Competence*, S.L. Willis and S.S. Dubin (eds.). San Francisco: Jossey-Bass, pp. 44-48.
- Ferratt, T.W., Agarwal, R., Brown, C., and Moore, J.E. 2005. "IT Human Resource Management Configurations and IT Turnover: Theoretical Synthesis and Empirical Analysis," *Information Systems Research* (16:3), pp. 237-255.
- Folkman, S., and Lazarus, R.S. 1988. "Coping as a Mediator of Emotion," *Journal of Personality and Social Psychology* (54:3), pp. 466-475.

- Fornell, C., and Larcker, D.F. 1981. "Evaluating Structural Equation Models with Observable Variables and Measurement Error," *Journal of Marketing Research* (18), pp. 39-50.
- Fugate, M., Kinicki, A.J., and Prussia, G.E. 2008. "Employee Coping with Organizational Change: An Examination of Alternative Theoretical Perspectives and Models," *Personnel Psychology* (61:1), Spr, pp. 1-36.
- Gathmann, C., and Schonberg, U. 2010. "How General Is Human Capital? A Task-Based Approach," *Journal of Labor Economics* (28:1), Jan, pp. 1-49.
- Gefen, D., Straub, D., and Boudreau, M.-C. 2000. "Structural Equation Modeling and Regression: Guidelines for Research Practice," *Communications of the Association for Information Systems* (4:7), August, pp. 1-78.
- Glass, R. 2000. "On Personal Technical Obsolescence," *Communications of the ACM* (43:7), Jul, pp. 15-17.
- Herman, J.L., and Tetrick, L.E. 2009. "Problem-Focused Versus Emotion-Focused Coping Strategies and Repatriation Adjustment," *Human Resource Management* (48:1), Jan-Feb, pp. 69-88.
- Hobfoll, S. 2002. "Social and Psychological Resources and Adaptations," *Review of General Psychology* (6), pp. 302-324.
- Hobfoll, S.E. 1989. "Conservation of Resources - a New Attempt at Conceptualizing Stress," *American Psychologist* (44:3), Mar, pp. 513-524.
- Hobfoll, S.E., and Freedy, J. 1993. "Conservation of Resources - a General Stress Theory Applied to Burnout," in: *Professional Burnout : Recent Developments in Theory and Research*, W.B. Schaufeli, C. Maslach and T. Marek (eds.). pp. 115-129.
- Hulland, J. 1999. "Use of Partial Least Squares (Pls) in Strategic Management Research: A Review of Four Recent Studies," *Strategic Management Journal* (20), pp. 195-204.
- Jex, S.M., and Yankelevich, M. 2008. "Work Stress," in: *The Sage Handbook of Organizational Behavior*, J. Barling and C.L. Cooper (eds.). Thousand Oaks, CA.: SAGE Publications, pp. 498-518.
- Joseph, D. 2006. "Examining the Role of Human Capital and Gender in Predicting IT Professionals' Career Transitions," *Academy of Management Annual Meeting*, Atlanta, GA.
- Joseph, D., and Ang, S. 2001. "The Threat-Rigidity Model of Professional Obsolescence and Its Impact on Occupational Mobility of IT Professionals," *Twenty-Second International Conference on Information Systems*, New Orleans: Association for Information Systems, pp. 567-573.
- Joseph, D., Boh, W.F., Ang, S., and Slaughter, S. Forthcoming. "Careers of the Information Technology Workforce: An Analysis of Career Sequences, Mobility and Objective Career Success," *MIS Quarterly*.
- Joseph, D., Ng, K.M., Koh, S.K.C., and Ang, S. 2007. "Turnover of Information Technology Professionals: A Narrative Review, Meta-Analytic Structural Equation Modeling, and Model Development," *MIS Quarterly* (31:3), pp. 547-577.
- Kambourov, G., and Manovskii, I. 2009. "Occupational Mobility and Wage Inequality," *Review of Economic Studies* (76:2), Apr, pp. 731-759.
- Kinicki, A.J., Prussia, G.E., and McKee-Ryan, F.M. 2000. "A Panel Study of Coping with Involuntary Job Loss," *Academy of Management Journal* (43:1), Feb, pp. 90-100.
- Kozlowski, S.W.J., and Farr, J.L. 1988. "An Integrative Model of Updating and Performance," *Human Performance* (1), pp. 5-29.
- Kozlowski, S.W.J., and Hults, B.M. 1987. "An Exploration of Climates for Technical Updating and Performance," *Personnel Psychology* (40), pp. 539-563.
- Lazarus, R.S., and Folkman, S. 1984. *Stress, Appraisal, and Coping*. New York, NY.: Springer.
- Lee, D.M.S., Trauth, E.M., and Farwell, D. 1995. "Critical Skills and Knowledge Requirements of IS Professionals - a Joint Academic-Industry Investigation," *MIS Quarterly* (19:3), Sep, pp. 313-340.
- Mithas, S., and Krishnan, M.S. 2008. "Human Capital and Institutional Effects in the Compensation of Information Technology Professionals in the United States," *Management Science* (54:3), Mar, pp. 415-428.
- Nelson, R.R. 1991. "Educational Needs as Perceived by IS and End-User Personnel: A Survey of Knowledge and Skill Requirements," *MIS Quarterly* (15:4), pp. 503-525.
- Ng, T.W.H., and Feldman, D.C. 2007. "Organizational Embeddedness and Occupational Embeddedness across Career Stages," *Journal of Vocational Behavior* (70:2), Apr, pp. 336-351.
- O'Mahony, S., and Bechky, B.A. 2006. "Stretchwork: Managing the Career Progression Paradox in External Labor Markets," *Academy of Management Journal* (49:5), Oct, pp. 918-941.
- Pazy, A. 1990. "The Threat of Professional Obsolescence - How Do Professionals at Different Career Stages Experience IT and Cope with IT," *Human Resource Management* (29:3), Fal, pp. 251-269.
- Pazy, A. 1994. "Cognitive Schemata of Professional Obsolescence," *Human Relations* (47), pp. 1167-1199.
- Pazy, A. 1996. "Concept and Career-Stage Differentiation in Obsolescence Research," *Journal of Organizational Behavior* (17:1), Jan, pp. 59-78.

- Pazy, A. 2004. "Updating in Response to the Experience of Lacking Knowledge," *Applied Psychology-an International Review-Psychologie Appliquee-Revue Internationale* (53:3), Jul, pp. 436-452.
- Pazy, A., and Goussinsky, R. 1995. "Professionals Experience of Lack of Knowledge - a Phenomenological Study," *Journal of Social Behavior and Personality* (10:4), Dec, pp. 907-922.
- Potosky, D., and Ramakrishna, H.V. 2002. "The Moderating Role of Updating Climate Perceptions in the Relationship between Goal Orientation, Self-Efficacy, and Job Performance," *Human Performance* (15:3), pp. 275-297.
- Reich, B.H., and Kaarst-Brown, M.L. 1999. "'Seeding the Line": Understanding the Transition from IT to Non-IT Careers," *MIS Quarterly* (23:3), pp. 337-364.
- Reich, B.H., and Kaarst-Brown, M.L. 2003. "Creating Social and Intellectual Capital through IT Career Transitions," *Journal of Strategic Information Systems* (12:4), pp. 91-109.
- Rong, G., and Grover, V. 2009. "Keeping up-to-Date with Information Technology: Testing a Model of Technological Knowledge Renewal Effectiveness for IT Professionals," *Information & Management* (46:7), Oct, pp. 376-387.
- Rusbult, C.E., Farrell, D., Rogers, G., and Mainouss III, A.G. 1988. "Impact of Exchange Variables on Exit, Voice, Loyalty, and Neglect: An Integrative Model of Responses to Declining Job Satisfaction," *Academy of Management Journal* (31:3), pp. 589-599.
- Schambach, T.P. 1994. "Maintaining Professional Competence: An Evaluation of Factors Affecting Professional Obsolescence of Information Technology Professionals." Tampa: University of South Florida, p. 207.
- Shiloh, S., Berkenstadt, M., Meiran, N., BatMiriamKatznelson, M., and Goldman, B. 1997. "Mediating Effects of Perceived Personal Control in Coping with a Health Threat: The Case of Genetic Counseling," *Journal of Applied Social Psychology* (27:13), Jul, pp. 1146-1174.
- Spence, M. 1973. "Job Market Signaling," *Quarterly Journal of Economics* (87), pp. 355-374.
- Steiner, D.D., and Farr, J.L. 1986. "Career Goals, Organizational Reward Systems and Technical Updating in Engineers," *Journal of Occupational Psychology* (59), pp. 13-24.
- Tesluk, P.E., and Jacobs, R.R. 1998. "Toward an Integrated Model of Work Experience," *Personnel Psychology* (51:2), pp. 321-355.
- Tsai, H.Y., Compeau, D., and Haggerty, N. 2007. "Of Races to Run and Battles to Be Won: Technical Skill Updating, Stress, and Coping of IT Professionals," *Human Resource Management* (46:3), Fal, pp. 395-409.
- Wingreen, S.C., and Blanton, J.E. 2007. "A Social Cognitive Interpretation of Person-Organization Fitting: The Maintenance and Development of Professional Technical Competency," *Human Resource Management* (46:4), Win, pp. 631-650.