EXPLORING THE LINK BETWEEN HIGH PERFORMANCE WORK SYSTEMS AND INNOVATION

By

SAEHEE KANG

A Thesis submitted to the

Graduate School - New Brunswick

Rutgers, The State University of New Jersey

in partial fulfillment of the requirements

for the degree of

Master of Science

Graduate Program in Industrial Relations and Human Resources

Written under the direction of

David Lepak

and approved by

_____

_____

_____

New Brunswick, New Jersey

October, 2015

ABSTRACT OF THE THESIS

Exploring the Link between High Performance Work Systems and Innovation

By SAEHEE KANG

Thesis Director:
David Lepak

This study examines processes linking high-performance work systems (HPWS) and innovation performance. I propose that HPWS are positively related to innovative climate, individual creativity, and organizational innovation. This study further investigates the possibility that the relations between HPWS and creativity and innovation are moderated by innovative climate. Based on a sample of R&D units in South Korea, this study provides novel insight into how firms can facilitate innovation process in such a way that creative ideas are successfully produced and implemented for innovation.

TABLE OF CONTENTS

INTRODUCTION

Innovation is fundamental to organizational performance and success (Amabile, 1996; Manso, 2007; McGrath, 2001; Tsai, 2001). Various scholars argue that innovation is one of key drivers that lead long-term success and growth (Manso, 2007; McGrath, 2001; Schumpeter, 1982; Tsai, 2001). Moreover, substantial practitioner-oriented literature suggests that innovation is beneficial to survive and thrive in increasingly competitive markets (Kim & Maubourgne, 2005). Indeed, Meta-analytic evidence identifies innovation as crucial in improving performance and achieving a continuous competitive advantage (Rosenbusch, Brinckmann, & Bausch, 2011). It is therefore not surprising that R&D intensity and the number of R&D workers as a share of the labor force grew over the last decade in OECD countries, especially in the United States, the EU, Japan, and Korea (OECD, 2014).

Existing research has suggested that innovation is subject to a variety of organizational factors, such as structure, strategy, size, resources, and culture (For review, see Anderson, De Dreu, & Nijstad, 2004). While many factors can influence innovation performance, researchers have recently called for a better understanding of the effect of HRM for R&D workers on innovation (Chang, Jia, Takeuchi, & Cai, 2014; Jimenez-Jimenez & Sanz-Valle, 2008). This is because R&D workers and units play a vital role in firm performance and economic growth through innovative outcomes (Balkin, Markman, & Gomez-Mejia 2000). While scholars have begun to examine the influence of HR systems on creativity and innovation (e.g., Chang, Jia, Takeuchi, & Cai, 2014), important

issues remain regarding the mechanisms through which HR systems are associated with innovation outcomes.

First, SHRM researchers frequently ignored the potential existence of different HR systems within a firm. While prior studies have focused on the link between an organization's overarching HR system and performance, organizations tend to have multiple HR systems for different groups of employees. Lepak & Snell (1999) suggest that diverse HR systems can exist within firms simultaneously. In line with this argument, Lepak, Taylor, Tekleab, Marrone, & Cohen (2007) found that organizations used high-investment HR systems more for core employees than for non-core employees. Considering that different employee groups can be managed differently, and different employee groups focus on different objectives, it is important to identify the particular segment of workers that are most relevant for contributing to innovation within organizations. In many organizations, that group of employees comprises the research and development workers.

Second, more refined understanding can be obtained if scholars can identify contextual factors that may influence the relationship between HR systems and innovation outcomes. Adoption of a contingency approach suggests that the impact of HR systems on organizational performance is conditioned by other factors (Delery & Doty, 1996). Prior research shows that the contribution of HR systems to performance may depend on contingencies such as business strategy (Youndt, Snell, Dean, & Lepak, 1996), technology (Snell & Dean, 1992), capital structure (Koch & McGrath, 1996), and industry characteristics (Datta, Guthrie, & Wright, 2005). Exploring the potential boundary conditions for the effectiveness of HR systems will likely provide a broader

picture of the relationship between HR systems and organizational outcomes. In particular, the current study proposes that innovative climate plays a moderating role in the relationship between HPWS for R&D workers and innovative outcomes.

Third, only a few studies investigated both creativity and innovation as potential outcomes of HR systems. Although both creativity and innovation capture the development of new or novel ideas, scholars often distinguish the concept of creativity from that of innovation (Baer, 2012). In particular, creativity refers to the generation of novel and useful ideas by individuals or teams, while innovation involves implementation of these ideas in an organization (Amabile, 1996; Oldham & Cummings, 1996). Examining both individual creativity and organizational innovation may provide a broader understanding of the role of HR systems in the innovation process, as HRM may influence organizational innovation performance through a more proximal individual creativity.

Given these issues, the primary objective of this study is to explore the link between high-performance work systems (HPWS) on individual creativity and organizational innovation. Drawing on the resource-based view (RBV) of the firm (Barney, 1991; Wernerfelt, 1984) and the behavioral perspective (Schuler & Jackson, 1987; Jackson, Schuler, & Rivero, 1989), this study suggests that HPWS may enhance a firm's innovative climate, individual creativity, and organizational innovation performance. Furthermore, I propose that innovative climate moderates the extent to which HPWS are associated with individual creativity and organizational innovation. By doing so, this study tries to integrate the literature on HPWS and innovation and develops a conceptual argument for the impact of HPWS on innovative outcomes. Figure 1

outlines the theoretical framework of the influence of HPWS on innovative outcomes and the moderating role of a firm's innovative climate.

Insert Figure 1 about Here

THEORETICAL BACKGROUND AND HYPOTHESES

High Performance Work Systems

Several conceptualizations of HR systems have been proposed in the literature. For example, Arthur (1992, 1994) suggested that HR practices can be seen as either control or commitment oriented in nature. Control-oriented HR systems tend to emphasize efficiency and seek to reduce labor costs via lower skill demands, little training, centralized decision making, narrowly defined jobs, etc. In contrast, commitment-oriented HR systems focus on organizational effectiveness by developing committed employees and encouraging them to work hard to accomplish their organizational goals. Commitment-oriented HR systems, therefore, include practices such as selective staffing, high-level compensation, intensive training, and promotion opportunity.

Another HR system that has received considerable attention in the SHRM literature is high performance work systems (HPWS). HPWS refer to a system of aligned employment practices designed to affect both the ability and the motivation of employees that contribute to the attainment of organizational objectives (Huselid, 1995; Jiang, Lepak, Hu, & Baer, 2012; Patel, Messersmith, & Lepak, 2013). It consists of nearly all types of best HR practices such as selective staffing, intensive training, individual and group incentives, performance appraisal, empowerment, and job rotation for achieving organizational goals (Jiang et al., 2012; Lepak, Liao, Chung, & Harden, 2006). Cumulative research has found that HPWS are associated with lower turnover rate (Batt, 2002), higher labor productivity and quality (Datta, Guthrie, & Wright, 2005; McDuffie,

1995), enhanced safety (Zacharatos, Barling, & Iverson, 2005), and better financial performance (Huselid, 1995).

Despite the evidence for positive relationships between HPWS and organizational performance, it is questionable whether a bundle of HR practices for generic productivity positively influences R&D workers' creativity and innovation performance. Indeed, many studies draw attention to the belief that the management of R&D workers is different from the management of other workers, and the distinction is necessary (Ferris & Cordero, 2002; Badawy, 2007). For example, it has been suggested that extrinsic rewards can be detrimental to creativity, and some empirical studies found that performance-based pay is negatively associated with innovative outcomes (Thompson & Heron, 2006; Shipton, Fay, West, Patterson, & Birdi, 2005). Given the limited empirical evidence, this study examines the impact of HPWS on innovative outcomes.

To explain the relationship between a bundle of HR practices and organizational performance, the resource-based view (RBV) of the firm (Barney, 1991; Wernerfelt, 1984) and the behavioral perspective (Schuler & Jackson, 1987; Jackson, Schuler, & Rivero, 1989) have been widely used as theoretical perspectives in SHRM. The RBV and human capital theory focus on the potential contributions of human capital and provide a framework to help researchers understand the potential sources of competitive advantage that could be generated through investment in human capital. According to Barney (1991), resources internal to the firm are sources of competitive advantage to the extent that they are valuable, rare, inimitable, and difficult to substitute. Since human resources may meet these four criteria (Wright, McMahan, & McWilliams, 1994; Barney & Wright, 1998), RBV assumes that human capital can be important sources of competitive

advantage and adoptability. Scholars, therefore, have increasingly included human capital among the intangible assets that potentially have strategic value.

On the other hand, the behavioral perspective focuses on the interdependent role behaviors that serve as building blocks for an organizational system (Jackson, Schuler, & Rivero, 1989; Schuler & Jackson, 1987). This perspective proposes that HR practices motivate employees to exhibit the needed role behaviors associated with various strategies. For example, performance management practices communicate the expectations that members of the organization have for its people's behavior. They shape the aspirations of organizational members and also facilitate the achievement of those aspirations through formal and informal rewards and punishment. Therefore, HPWS that are designed to elicit employees to act in ways that are consistent with organizational goals may lead a number of behaviors and outcomes that provide benefits to the organization.

More recently, researchers have drawn upon the ability-motivation-opportunity (AMO) model of HRM and suggest that HR affects organizational and individual performance through a function of three essential components: ability, motivation, and opportunity (Lepak, et al., 2006; Jiang et al., 2012). According to this model, HR practices can be categorized into one of three primary dimensions. For example, comprehensive recruitment, selective staffing, and extensive training are HR practices that are designed to ensure employees' ability. Performance appraisal and incentives are HR practices that enhance employees' motivation. Lastly, employee participation and involvement and flexible job design are HR practices that empower employees to use their skills and motivation. In sum, the AMO model suggests that HPWS affect

employees' ability, motivation, and opportunity, all of which help the achievement of organizational goals and objectives. This theoretical framework has been used and validated by a recent meta-analysis (Jiang et al., 2012).

Creativity and Innovation

This study proposes that organizations might be able to enhance employees' creativity and promote organizational innovation by offering HPWS. While creativity and innovation are frequently perceived to be so closely linked, it is important to note that, in the organizational context, scholars distinguish the concept of creativity from that of innovation. Whereas creativity involves the generation of novel and useful ideas by individuals (Amabile, 1996; Zhou & Shalley, 2003), innovation encompasses the successful implementation of creative ideas within an organization (Amabile, 1988; Amabile, Conti, Coon, Lazenby, & Herron, 1996). Therefore, scholars often view creativity as an individual-level variable and innovation as a group or organizational-level construct (Oldham & Cummings, 1996).

According to the componential theory by Amabile (1988), motivation and skills (both domain-relevant and creativity-relevant skills) are key factors influencing creativity and innovation in an organizational setting. Domain-relevant skills refer to knowledge, experience, technical skills, intelligence, and talent in the particular domain in question. Creativity-relevant skills include the ability to adopt new perspectives on problems and to develop skills regarding generating ideas. Task motivation is the drive to undertake a task or solve a problem. The theory specifies that creativity should be highest when a motivated person with high skill works in an environment high in supports for creativity.

Similarly, organizational innovation depends on skills and motivation as well as resources.

Influences of HPWS on innovative climate, creativity, and innovation

Organizational climate refers to the organizational members' shared perception of formal and informal organizational policies, practices, and procedures (Reichers & Schneider, 1990; Schneider, White, & Paul, 1998). Scholars have proposed organizational climate as a key intermediate variable between HR systems and organizational outcomes (Ostroff & Bowen, 2000; Lepak et al., 2006). For example, Ostroff & Bowen (2000) suggest that an HR system shapes the organizational climate, which in turn influences employee attitudes and behaviors. Unfortunately, however, relatively few empirical studies to date have reported the impact of HPWS on organizational climate.

HPWS may be positively associated with innovative climate in R&D units. Indeed, scholars call for using organizational climate as a specific construct that has a particular criterion of interest rather than including everything. While empirical studies have shown a positive relationship between a HR system and service climate (Chuang & Liao, 2010), empowerment climate (Aryee, Walumbwa, Seidu, & Otaye, 2012) and concern for employees climate (Takeuchi, Chen, & Lepak, 2009), no study to date has examined the relationship between HPWS and innovative climate.

Innovative climate refers to "the shared perceptions of location members concerning the practices, procedures, and behaviors that promote the generation,

introduction, and realization of new ideas" (van der Vegt, van de Vliert, & Huang, 2005). In other words, innovative climate reflects organizational members' perception that their innovation efforts are expected, valued, and supported (Chen, Farh, Campbell-Bush, Wu, & Wu, 2013). Given the primary roles of R&D units and assuming that workers are enhancing and supporting innovation in organizations, HPWS can send a consistent message to R&D workers that innovative outcomes are highly expected and valued. Under the circumstances, R&D workers may feel that they are expected, supported, and rewarded for innovation, which results in a shared perception of innovative climate. Therefore, I propose the following hypothesis.

Hypothesis 1: HPWS for R&D workers are positively related to innovative climate.

Given that HPWS are a set of HR practices to enhance employee skills, motivation, and opportunity to contribute (Jiang et al., 2012), this study proposes that HPWS may positively affect individual creativity and organizational innovation. Among the HR practices within the HPWS bundle, in particular, ability-enhancing HR practices such as selective staffing and training directly enhance employees' knowledge and skills. For example, recruitment and selection may enable an organization to procure suitable employees who have the ability and skills needed for their jobs. Similarly, training further helps employees to develop skills and knowledge that relate to their specific tasks. Indeed, prior empirical studies have shown that the use of ability-enhancing HR practices fosters individual KSAOs and collective human capital (Jiang et al., 2012; Liao, Toya,

Lepak, & Hong, 2009; Takeuchi, Lepak, Wang, & Takeuchi, 2007). These results support the RBV that proposes HPWS will be positively related to organizational performance through the mediation of employee human capital.

In addition, motivation-enhancing HR practices such as performance-based compensation and performance appraisal are likely to have a strong and positive impact on individual motivation. The incentive theory of motivation predicts that people are pulled toward behaviors that offer positive incentives. For example, performance-based compensation may provide employees with motivation to improve their task performance. Research has shown that the use of motivation-enhancing HR practices positively affects employee motivation (e.g., Jiang et al., 2012; Minbaeva, Pederse, Björkman, Fey, & Park, 2003). These empirical results are in line with the behavioral perspective that suggests that employee attitudes may mediate the relationship between HPWS and performance outcomes.

While opportunity-enhancing HR practices are primarily designed to empower employees to use their skills and motivation, they are also likely to be related to employee skills and motivation. For example, job rotation provides employees with opportunities to share knowledge and to learn new skills (Campion, Cheraskin, & Stevens, 1994). This may further enable employees to think out of the box (Madjar & Oldham, 2006). Similarly, empowerment helps employees to generate motivation to seek out challenges at work (Ryan & Deci, 2000).

Given that skills and motivation are key antecedents of creativity and innovation (Amabile, 1996), I expect HPWS to be positively associated with R&D workers'

creativity and organizational innovation through improved skills and motivation. Indeed, empirical evidence shows that HCWS are positively associated with employees' creativity (Chang et al., 2014). Takeuchi et al. (2007) and Collins & Smith (2006) also found that HPWS encourage a high degree of social exchange and knowledge sharing within an organization, which has been shown to facilitate the innovation process (Jia, Shaw, Tsui, & Park, 2014; Perry-Smith, 2006; Perry-smith & Shalley, 2003; Tsai, 2001). Therefore, I hypothesize the following:

Hypothesis 2: HPWS for R&D workers are positively related to individual creativity.

Hypothesis 3: HPWS for R&D workers are positively related to organizational innovation.

Interaction between HPWS and innovative climate

It should be noted that HPWS are not HR systems for innovation. While innovative outcomes are likely to be the most important performance measures for R&D workers, HPWS include almost all kinds of best HR practices associated with generic productivity. Therefore, empirical evidence show that HPWS can facilitate different kinds of performance measures such as productivity performance (Huselid, 1995), contextual performance (Gong, Chang, & Cheung, 2010; Messersmith, Patel, Lepak, & Gould-Williams, 2011), safety performance (Zacharatos et al., 2005), and service performance (Liao et al., 2009).

Considering that the organizational climate helps individuals to determine what behavior is expected and valued in their workplace and guides employee behavior towards organizational goals (Schneider, 1983), I expect that the innovative climate would moderate the relationship between HPWS and innovation outcomes. In particular, innovative climate is expected to strengthen the relationship between HPWS and individual creativity and organizational innovation. In favorable climates for innovation, R&D workers are more likely to believe that innovation is much more important than other performance measures for their unit functioning, and they will receive support when directing effort toward producing creative ideas and implementing them (West, 1990). Thus, they would be attracted to building creative abilities and motivated to pursue innovation by leveraging the benefits of HPWS.

An innovative climate also captures an important motivational state by alleviating perceived risks associated with the innovation process. While HPWS are likely to be related to different types of performance measures, innovation involves risks, uncertainties, and potential failure (Chang et al., 2014). Prior research has shown that innovative behavior often creates conflict with coworkers. Moreover, individuals may suffer losses of reputation and withdrawal of trust of coworkers and supervisors if their creative ideas fail to produce anticipated positive returns (Yuan & Woodman, 2010). Therefore, individuals with high risk avoidance may focus less on innovation performance, even if the organization facilitates HPWS. Under this circumstance, individuals may consider a high-innovative climate as a sign of safe exchange relationships with the organization to be more innovative in the workplace. In other words, the expectation of safety being associated with their creativity and implementation

efforts may motivate R&D workers to implement their novel ideas (Baer, 2012). Even if employees acquire the knowledge and skill to create new ideas through skill-enhancing HR practices, on the other hand, they will be less likely to engage in innovative behavior when they perceive that engaging in such behavior is not valuable and meaningful in their group or organization. Therefore, I expect that the innovative climate would moderate the relationship between HPWS and R&D workers' creativity and organizational innovation performance.

Hypothesis 4a: Innovative climate will strengthen the relationship between HPWS for R&D workers and creativity, such that the relationship will be stronger when the innovative climate is high than when it is low.

Hypothesis 4b: Innovative climate will strengthen the relationship between HPWS for R&D workers and innovation, such that the relationship will be stronger when innovative climate is high than when it is low.

METHODS

Sample

Unit-level sample. To test these hypotheses, I used data from a unique survey from South Korea. The survey was conducted by the Korea Labor Institute (KLI), a government-funded research organization, in September 2012. KLI contacted all 675 firms that have their own R&D units. 200 HR managers in R&D units voluntarily completed the survey about the HR practices implemented in their unit for R&D workers. They also provided other unit-level variables such as unit size and R&D intensity. No organization had multiple R&D units in this sample. The R&D units ranged in size from 5 to 550 researchers (median=36). This data was supplemented with the patent information provided by the Korean Intellectual Property Office (KIPO). The final sample consists of 164 R&D units, yielding an overall response rate of 24.3%, and this data was used to test hypothesis 1, 3, and 4b.

Multi-level sample. Among the 200 R&D units that completed the unit-level survey, 69 of them also provided individual-level data. Due to some missing data, however, the final sample of 332 researchers from 57 units, with at least three individuals per unit, was used to test the multi-level hypotheses. The R&D units ranged in size from 5 to 420 researchers (median=36) and the mean number of respondents per unit was 5.76. R&D workers' average age was 34, and 16% of them were women.

Variables

HPWS. I assessed HPWS using 20 items on a five-point scale that involve various practices of HPWS. Selective staffing (e.g., "great effort to select right person"), extensive training (e.g., "extensive investment on training"), performance-based pay (e.g., "close tie of pay to department's performance"), and empowerment (e.g., "providing chances to use personal initiative") were adopted from Bae & Lawler (2000). Performance appraisal (e.g., "performance appraisal for personal development"), relatively high pay (e.g., "a wage level is higher than competitors"), and job rotation (e.g., "provides job rotation opportunities") were developed specifically for this study. Table 1 shows all items used to measure HPWS. The coefficient alpha was .90 for the scale.

Insert Tables 1 about Here

Innovative climate. Innovative climate was measured with a six-item scale used by Anderson & West (1998). HR managers for R&D workers were asked to rate their unit's innovative climate on a five-point scale ranging from 1, "not at all," to 5, "all the time." While organizational climate refers to the organizational members' shared perception, a unit manager is a potentially reliable respondent regarding unit climate. In addition, having a high enough number of individual respondents per unit to aggregate the variable at the unit level was not feasible due to the practical difficulties. Sample items are "assistance in developing new ideas is readily available" and "co-operate in order to help develop and apply new ideas." The coefficient alpha was .88.

Creativity. R&D workers' creativity was measured using the four-item scale reported by Farmer, Tierney, & Kung-McIntyre (2003). R&D workers rated creativity on a five-point scale ranging from 1, "not at all," to 5, "all the time." A sample item is "I try new ideas or methods first." The coefficient alpha was .90. Although self-reported measures are subject to bias, self-reported creativity has been found to correlate highly (.62) with supervisory ratings of creativity (Axtell, Holman, & Unsworth, 2000).

Innovation performance. The dependent variable is innovation performance. In fact, many studies have found similar results involving subjective measures such as supervisory ratings or self-report measures of the innovative performance and objective measures. However, objective innovation measures such as a number of patents registered are considered to be more accurate and reliable, because they do not raise the issue of common method bias. In this study, therefore, I used the number of patents registered in 2013 and 2014 provided by the Korean Intellectual Property Office. Among 164 R&D units, 38 units had no patent registered in 2013 and 2014. The mean number of the variable was 20.

Control variables. In order to rule out alternative explanations, I included a number of control variables as suggested by prior innovation research. Four control variables were included to explore the determinants of innovative climate and organizational innovation. First, firm age, which is calculated as the difference between the year when a firm was founded and the year the firm was observed in the sample, would be controlled. Second, unit size was controlled, as organizations may be more able to innovate when they have greater human resources (Harrison, Price, Gavin, & Florey, 2002). The number of researchers was used to control for unit size. Third, I controlled for

the R&D intensity that importantly impacts an organization's innovative output (Ahuja & Lampert, 2001). Lastly, I controlled for an industry dummy that likely faces different market conditions. A two-digit SIC code was used. To test influences of HPWS and innovative climate on individual creativity, six control variables were included. At the individual level, sex (0=male; 1=female), age, and organizational tenure were controlled. At the organization level, the number of R&D workers is used to control for unit size. I also controlled for firm age and R&D intensity.

Methodology

To test hypothesis 1, an OLS regression was used. Hypotheses 3 and 4b are concerned with the influences of HPWS and innovative climate on organizational innovation. As the dependent variable had a nonnegative count, a negative binomial regression was conducted to test hypotheses 3 and 4b. Hypotheses 2 and 4a suggested that individual creativity would be associated with unit-level variables. To test these hypotheses, hierarchical linear modeling (HLM) was conducted, as the employees are nested within the units. In addition, Hypotheses 4a and 4b predicted that the effects of HPWS on individual creativity and organizational innovation would be moderated by innovative climate. To test the interaction effects, a series of regression analysis was conducted following Aiken & West (1991).

RESULTS

Unit-level Analyses

Table 2 summarizes the means, standard deviations, and correlations among the unit-level variables. Hypothesis 1 predicted that HPWS for R&D workers would positively influence innovative climate. As shown in Model 2 in Table 3, HPWS had a significant and positive relationship with innovative climate (β =.553, $p < .01$). Also, the R-square significantly increased from .124 in Model 1 to .310 in Model 2. Therefore, Hypothesis 1 was supported.

Insert Tables 2-3 about Here

Hypothesis 3 predicted that HPWS would have a positive effect on innovation performance. The result of Model 4 in Table 3 shows that HPWS were significantly related to organizational innovation (β = .77, $p < .05$). The result supported Hypothesis 3. Hypothesis 4b stated that innovative climate would moderate the relation between HPWS and organizational innovation in such a way that the relationship will be stronger when innovative climate is high than when it is low. In keeping with this hypothesis, the HPWS by innovative climate two-way interaction entered in model 5 was positive and statistically significant (β =1.189, $p < .01$). Therefore, Hypothesis 4b was supported. To further illustrate the pattern of the interactive effect, I plotted the interactive effect in Figure 2 using the approach suggested by Aiken & West (1991). The plots show that,

when innovative climate was high (1 SD above the mean), HPWS was positively related to organizational innovation.

Insert Figure 2 about Here

Multi-level Analyses

In order to test Hypotheses 2 and 4a, a subset of the data was analyzed. Among 164 R&D units, in particular, 332 researchers from 57 R&D units provided individual-level data. Table 4 presents descriptive statistics and correlations for the multi-level study variables.

Insert Tables 4-5 about Here

To justify the use of HLM, a null model with no predictor was tested. The results show that there was significance between-unit variance ($\chi 2$ (56) = 84.33, $p < .01$, ICC1 = .10). The results show that the variance of 10 percent of individual creativity resided between organizations. This variance is similar to the typical values reported elsewhere (e.g., .05-.12; Bliese, 2000). Therefore, the results support the use of HLM to test the hypotheses.

Table 5 shows the results of HLM analyses testing the multilevel hypotheses. Hypothesis 2 proposed that HPWS will be positively associated with individual creativity. Consistent with the prediction, results in Model 2 of Table 5 show that the effect of HPWS on individual creativity was positive and statistically significant ($\gamma = .169$, $p < .05$). Therefore, Hypothesis 2 was supported. Hypothesis 4a suggested that an innovative climate moderates the relationship between HPWS and individual creativity. As shown in Model 3 in Table 5, the moderating effects of innovative climate on the relationship between HPWS and individual creativity was positive and statistically significant ($\gamma = .30$, $p < .01$). Providing initial support for Hypothesis 4a, simple-slope analyses further indicated that the relation between HPWS and individual creativity was only positive and statistically significant when innovative climate is high. These slopes are displayed in Figure 3.

Insert Figure 3 about Here

Additional Analyses

Although specific hypotheses were not proposed, alternative models were tested to provide a broader picture of the relationship between HPWS and innovative outcomes. Specifically, the mediating role of creativity in the relationship between HPWS and organizational innovation was examined. Creativity has been established as a most important fundamental driver that serves as a basis for innovation, and scholars have

generally shared the assumption that a firm with knowledge workers high in creativity is more likely to generate innovative outcomes.

The average within-group interrater agreement (r_{wg}), the intraclass correlation 1 (ICC1), and the intraclass correlation 2 (ICC2) for creativity was tested to justify aggregation (Bliese, 2000; James, Demaree, & Wolf, 1984). The mean r_{wg} for creativity was .86 (range = .64-.98). The intraclass correlation 1 and 2 statistics were .10 and .40, respectively. The ICC2 value obtained was somewhat low. As ICC2 value is a function of ICC1 and group size, small group size may result in less reliable group means for this variable. However, the results of one-way random effects analysis of variance (ANOVA) indicated significant unit-level variance in creativity ($F(56)=84.33$, $p < .01$). Taking the evidence on r_{wg} and ICC1, therefore, individual creativity was aggregated to the unit level.

Insert Tables 6 about Here

To test the mediating role of team creativity, a series of regression analyses with the relevant models were performed following Baron & Kenny (1986). As reported in Model 7 in Table 6, unit creativity was positively related to innovation performance ($\beta = 2.41$, $p < .01$). I further included both HPWS and unit creativity in Model 8. The results show that unit creativity significantly predicted innovation performance ($\beta = 1.63$ $p < .05$), while the effect of HPWS on the prediction of innovation performance becomes nonsignificant. However, HPWS were not significantly associated with unit creativity as

shown in Model 2. Therefore, unit creativity did not mediate the positive relationship between HPWS and innovation performance.

A mediated moderation model was also tested following Edwards & Lambert (2007). Although conditional process analysis was widely used to test a mediated moderation model (Hayes, 2013), the use of the PROCESS macro was not feasible, as it did not support a negative binomial regression. As shown in Model 3 and Model 6 in Table 6, the interaction between HPWS and innovative climate was positively associated with unit creativity ($\beta = .35$, $p < .05$) and innovation performance ($\beta = 1.75$, $p < .01$). Also, unit creativity was positively related to organizational innovation performance ($\beta = 2.41$, $p < .01$) in Model 7. I further included both unit creativity and the interaction between HPWS and innovative climate in Model 8. The results show that unit creativity is significantly associated with innovation performance ($\beta = 1.63$, $p < .05$), while the effect of the interaction between HPWS and innovative climate becomes nonsignificant. These results provide support for a mediated moderation model under which innovative climate influences the strength of the HPWS-innovation relationship via team creativity.

DISCUSSION

Recent studies have called for an integration of multilevel concepts within organizations to advance both the SHRM (e.g., Paauwe, 2009) and innovation research (e.g., Hennessey & Amabile, 2010). In response to these calls, I developed a multilevel approach to individual creativity and organizational innovation. I proposed that HPWS would positively influence individual creativity and organizational innovation performance. Results based on R&D units and employees in South Korea supported this prediction. Furthermore, this study shows that HPWS have indirect effects on innovative outcomes through moderation via innovative climate. In particular, the impact of HPWS on innovative outcomes was optimized when organizational members have the collective perception that their innovation efforts are expected, valued, and supported.

Implications

This study may contribute to the strategic HRM and innovation literature in three primary ways. First, this study examined processes linking HPWS and innovative outcomes. The results show that HPWS were positively associated with innovative climate, individual creativity, and organizational innovation. Given that the research on innovation emphasizes the importance of creating favorable work environments in stimulating individual creativity and organizational innovation, this addition is important to identify favorable organizational contexts for innovation.

Second, this study introduces the moderating role of the organizational climate in the relationship between HPWS and innovative outcomes. Since HPWS consist of best

HR practices that are associated with generic productivity, it is questionable whether HPWS can significantly influence an organization's particular goal. By introducing innovative climate as a relevant moderator in the relationship between HPWS and innovative outcomes, this study shows that organizational climate may enable firms to send a clear signal to their employees that a certain outcome is highly expected and valued when they utilize HPWS.

Third, this research responds to the call for a fine-grained, multilevel approach in the SHRM literature (Paauwe, 2009). Multi-level research designs have the potential to open up the "black box" between HR systems and organizational performance, as employees play an important role in mediating the impact of HR systems on organizational performance. This study shows that HPWS positively influence R&D workers' creativity by providing motivation to build creative abilities and to pursue innovative outcomes.

Limitations

While this study provides several implications for the innovation and strategic HRM literature, it also has several limitations. First, this study used self-reported creativity. While self-reported creativity is subject to bias, several studies have found self-reported creativity to be highly correlated with the supervisory ratings of creativity (Axtell, Holman, & Unsworth, 2000). Furthermore, Janssen (2000) found that self-reported innovative behaviors are significantly correlated with supervisors' ratings. While these results provide some confidence in the data, future research should incorporate third-party evaluations of creativity.

Second, considering that organizational climate refers to the organizational members' shared perception of organizational policies, practices, and procedures, individuals are the most appropriate respondents. In this study, however, unit managers rated their climate for innovation due to practical problems associated with having a high enough number of individual respondents per unit to aggregate the variable at the unit level. Organizational climate relates to unit-level climate via supervisory actions (Zohar, 2000), and therefore a unit manager is a potentially reliable respondent regarding unit climate. Indeed, McKay, Avery, & Morris (2009) and Bashshur, Hernández, & González-Romá (2011) also used manager-rated climate in predicting unit and team outcomes. However, the results should be interpreted with caution, since it is questionable whether there is significant unit variance in innovative climate perceptions.

Third, this study used the number of patents registered in a given period to measure organizational innovation performance. While objective innovation measures are considered more reliable than subjective measures, it is by no means perfect. For example, a certain type of innovations may take longer than two years to be implemented. A panel data design, which observes dependent variables over multiple periods and independent variables from multiple preceding periods, might better capture the effects of HPWS on innovation. Furthermore, not all innovations are equal in terms of their quality (Lahiri, 2010). I suggest that future research use both innovation quantity and quality measures in order to fully capture the innovation outcomes.

Fourth, I focused on HPWS and innovative outcomes in Korean organizations. Considering the fact that Korea ranks first among OECD countries in terms of its R&D intensity (OECD, 2014), there could be concerns regarding the generalizability of the

findings to other institutional and cultural contexts. It was not specified how the Korean context may affect the conclusions or whether the study results are applicable to other contexts. Although the theoretical framework is derived from a non-culturally specific literature, generalizability remains a central concern, and future studies should test whether the conclusions apply in the West.

Conclusion

Innovation is crucial in improving performance and achieving continuous competitive advantage (e.g., Rosenbusch, Brinckmann, & Bausch, 2011). Based on the strategic HRM perspective, this study attempted to delineate how HPWS can enhance the innovation performance of the R&D units and employees. This study proposes that HPWS positively influence innovative climate, individual creativity, and organizational innovation, and innovative climate moderates the relationship between HPWS and innovative outcomes. Using multi-level data from R&D units in South Korea, the hypotheses of this study were supported. The findings show how HPWS can promote the innovation process of organizations.

REFERENCES

Ahuja, G., & Lampert, C. M. (2001). Entrepreneurship in the large corporation: A longitudinal study of how established firms create breakthrough inventions. *Strategic Management Journal*, 22, 521-543.

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.

Amabile T. M. (1988). A model of creativity and innovation in organizations. In B.M. Straw and L.L. Cummings (Eds.), *Research in Organizational Behavior* (Vol. 10, pp. 123-167). Greenwich, CT: JAI Press.

Amabile, T. M. (1996). *Creativity in context*. Boulder, CO: Westview Press.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *Academy of management journal, 39,* 1154-1184.

Anderson, N.R., De Dreu, C. K., & Nijstad, B. A. (2004). The routinization of innovation research: A constructively critical review of the state-of-the-science. *Journal of organizational Behavior, 25,* 147-173.

Anderson, N. R., & West, M. A. (1998). Measuring climate for work group innovation: development and validation of the team climate inventory. *Journal of organizational behavior, 19,* 235-258.

Arthur, J. B. (1992). The link between business strategy and industrial relations systems in American steel minimills. *Industrial & Labor Relations Review, 45,* 488-506.

Arthur, J. B. (1994). Effects of human resource systems on manufacturing performance and turnover. *Academy of Management journal, 37,* 670-687.

Aryee, S., Walumbwa, F. O., Seidu, E. Y., & Otaye, L. E. (2012). Impact of high-performance work systems on individual-and branch-level performance: test of a multilevel model of intermediate linkages. *Journal of Applied Psychology, 97,* 287.

Axtell, C. M., Holman, D. J., Unsworth, K. L., Wall, T. D., Waterson, P. E., & Harrington, E. (2000). Shopfloor innovation: Facilitating the suggestion and implementation of ideas. *Journal of occupational and organizational psychology, 73,* 265-285.

Badawy, M. K. (2007). Managing Human Resources. *Research-Technology Management, 50,* 56.

Bae, J., & Lawler, J. J. (2000). Organizational and HRM strategies in Korea: Impact on firm performance in an emerging economy. *Academy of Management Journal, 43,* 502-517.

Baer, M. (2012). Putting creativity to work: The implementation of creative ideas in organizations. *Academy of Management Journal, 55,* 1102-1119.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17,* 99–120.

Barney, J. B. & Wright, P. M. (1998): On becoming a strategic partner: The role of human resources in gaining competitive advantage. *Human Resource Management, 37,* 31-46.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology, 51,* 1173.

Bashshur, M. R., Hernández, A., & González-Romá, V. (2011). When managers and their teams disagree: a longitudinal look at the consequences of differences in perceptions of organizational support. *Journal of Applied Psychology, 96,* 558.

Batt, R. (2002). Managing customer services: Human resource practices, quit rates, and sales growth. *Academy of management Journal, 45,* 587-597.

Becker, B. E., & Huselid, M. A. (2006). Strategic human resources management: where do we go from here? *Journal of Management, 32,* 898-925.

Bliese, P. D. (2000).Within-group agreement, non-independence, and reliability: Implications for data aggregation and analyses. In K. J. Klein&S.W. J.Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions* (pp. 349–381). San Francisco, CA: Jossey-Bass.

Campion, M. A., Cheraskin, L., & Stevens, M. J. (1994). Career-related antecedents and outcomes of job rotation. *Academy of Management Journal, 37,* 1518-1542.

Chang, S., Jia, L., Takeuchi, R., & Cai, Y. (2014). Do High-Commitment Work Systems Affect Creativity? A Multilevel Combinational Approach to Employee Creativity. *Journal of Applied Psychology, 99,* 665-680.

Chen, G., Farh, J. L., Campbell-Bush, E. M., Wu, Z., & Wu, X. (2013). Teams as innovative systems: Multilevel motivational antecedents of innovation in R&D teams. *Journal of Applied Psychology, 98,* 1018.

Chuang, C. H., & Liao, H. U. I. (2010). Strategic human resource management in service context: Taking care of business by taking care of employees and customers. *Personnel Psychology, 63,* 153-196.

Collins, C. J., & Smith, K. G. (2006). Knowledge exchange and combination: The role of human resource practices in the performance of high-technology firms. *Academy of management journal, 49,* 544-560.

Datta, D. K., Guthrie, J. P., & Wright, P. M. (2005). Human resource management and labor productivity: does industry matter? *Academy of management Journal, 48,* 135-145.

Edwards, J. R., & Lambert, L. S. (2007). Methods for integrating moderation and mediation: a general analytical framework using moderated path analysis. *Psychological methods, 12,* 1-22.

Farris, G. F., & Cordero, R. (2002). Leading your scientists and engineers. *Research Technology Management, 45,* 13–25.

Farmer, S. M., Tierney, P., & Kung-Mcintyre, K. (2003). Employee creativity in Taiwan: An application of role identity theory. *Academy of Management Journal, 46,* 618-630.

Gong, Y., Kim, T. Y., Zhu, J., & Lee, D. R. (2012). A multilevel model of team goal orientation, information exchange, and creativity. *Academy of Management Journal, 56,* 1611-1633.

Hagedoorn, J. and Cloodt, M. (2003). Measuring innovative performance: is there an advantage in using multiple indicators? *Research Policy, 32,* 1365–1379.

Harrison, D. A., Price, K. H., Gavin, J. H., & Florey, A. T. (2002). Time, teams, and task performance: Changing effects of surface-and deep-level diversity on group functioning. *Academy of management journal, 45,* 1029-1045.

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs, 76,* 408-420.

Hennessey, B. A., & Amabile, T. M. (2010). Creativity. *Annual Review of Psychology, 61,* 569-598.

Huselid, M. A. (1995). The impact of human resource management practices on turnover, productivity, and corporate financial performance. *Academy of management journal, 38,* 635-672.

Huselid, M.A., Jackson, S.E., and Schuler, R.S. (1997), Technical and Strategic Human Resource Management Effectiveness as Determinants of Organisation Performance, *Academy of Management Journal, 40,* 171–188.

Jackson, S. E., Schuler, R. S., & Rivero, J. C. (1989). Organizational characteristics as predictors of personnel practices. *Personnel Psychology, 42,* 727-786.

James, L. R., Demaree, R. G., & Wolf, G. (1993). r wg: An assessment of within-group interrater agreement. *Journal of applied psychology, 78,* 306.

Janssen, O. (2000). Job demands, perceptions of effort-reward fairness and innovative work behaviour. *Journal of Occupational and organizational psychology, 73,* 287-302.

Jia, L., Shaw, J., Tsui, A., & Park, T. Y. (2014). A social-structural perspective on employee-organization relationships and team creativity. *Academy of Management Journal, 57,* 869-891.

Jiang, K., Lepak, D. P., Hu, J., & Baer, J. C. (2012). How does human resource management influence organizational outcomes? A meta-analytic investigation of mediating mechanisms. *Academy of management Journal, 55,* 1264-1294.

Lahiri, N. (2010). Geographic distribution of R&D activity: how does it affect innovation quality? *Academy of Management Journal, 53,* 1194-1209.

Lepak, D. P., Liao, H., Chung, Y., & Harden, E. E. (2006). A conceptual review of human resource management systems in strategic human resource management research. *Research in personnel and human resources management, 25,* 217-271.

Lepak, D. P., Taylor, M. S., Tekleab, A. G., Marrone, J. A., & Cohen, D. J. (2007). An examination of the use of high-investment human resource systems for core and support employees. Human Resource Management, 46, 223-246.

Liao, H., Toya, K., Lepak, D. P., & Hong, Y. (2009). Do they see eye to eye? Management and employee perspectives of high-performance work systems and influence processes on service quality. *Journal of Applied Psychology, 94,* 371.

MacDuffie, J. P. (1995). Human resource bundles and manufacturing performance: Organizational logic and flexible production systems in the world auto industry. *Industrial and labor relations review, 48,* 197-221.

McKay, P. F., Avery, D. R., & Morris, M. A. (2009). A tale of two climates: Diversity climate from subordinates and managers perspectives and their role in store unit sales performance. *Personnel Psychology, 62,* 767-791.

Madjar, N., & Oldham, G. R. (2006). Task rotation and polychronicity: Effects on individuals' creativity. *Human Performance, 19,* 117-131.

Messersmith, J. G., Patel, P. C., Lepak, D. P., & Gould-Williams, J. S. (2011). Unlocking the black box: exploring the link between high-performance work systems and performance. *Journal of Applied Psychology, 96,* 1105.

Minbaeva, D., Pedersen, T., Björkman, I., Fey, C. F., & Park, H. J. (2003). MNC knowledge transfer, subsidiary absorptive capacity, and HRM. *Journal of international business studies, 34,* 586-599.

Miron-Spektor, E., Erez, M., & Naveh, E. (2011). The effect of conformist and attentive-to-detail members on team innovation: Reconciling the innovation paradox. *Academy of Management Journal*, *54*, 740-760.

Miron, E., Erez, M., & Naveh, E. (2004). Do personal characteristics and cultural values that promote innovation, quality, and efficiency compete or complement each other? *Journal of Organizational Behavior, 25,* 175-199.

Nishii, L. H., Lepak, D. P., & Schneider, B. (2008). Employee attributions of the "why" of HR practices: Their effects on employee attitudes and behaviors, and customer satisfaction. *Personnel psychology, 61,* 503-545.

OECD (2014), *Economic Outlook*, Paris: OECD.

Oldham, G. R. (2003). Stimulating and supporting creativity in organizations. In Jackson, S.E., Hitt, M.A. and DeNisi, A.S. (Eds.), *Managing Knowledge for Sustained Competitive Advantage* (pp. 243–273). San Francisco, CA: Jossey-Bass.

Oldham, G. R., & Cummings, A. (1996). Employee creativity: Personal and contextual factors at work. *Academy of management journal, 39,* 607-634.

Ostroff, C., & Bowen, D. E. 2000. Moving HR to a higher level: Human resource practices and organizational effectiveness. In K. J. Klein & S. W. J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations* (pp. 211–266). San Francisco, CA: Jossey-Bass.

Paauwe, J. (2009). HRM and performance: Achievements, methodological issues and prospects. *Journal of management studies, 46,* 129-142.

Patel, P. C., Messersmith, J. G., & Lepak, D. P. (2013). Walking the Tightrope: An Assessment of the Relationship between High-Performance Work Systems and Organizational Ambidexterity. *Academy of Management Journal, 56,* 1420-1442.

Perry-Smith, J. E. (2006). Social yet creative: The role of social relationships in facilitating individual creativity. *Academy of Management Journal, 49,* 85-101.

Perry-Smith, J. E., & Shalley, C. E. (2003). The social side of creativity: A static and dynamic social network perspective. *Academy of management review, 28,* 89-106.

Reichers, A. E., & Schneider, B. (1990). Climate and culture: An evolution of constructs. In B. Schneider (Eds.), *Organizational climate and culture* (pp. 5-39). San Francisco, CA: JosseyBass.

Rosenbusch, N., Brinckmann, J., & Bausch, A. (2011). Is innovation always beneficial? A meta-analysis of the relationship between innovation and performance in SMEs. *Journal of Business Venturing, 26,* 441-457.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist, 55,* 68.

Schneider, B. (1983). Interactional psychology and organizational behavior. In L. L. Cummings & B. M. Staw (Eds.), *Research in organizational behavior* (pp. 1-31). Greenwich, CT: JAI Press.

Schneider, B., White, S. S., & Paul, M. C. (1998). Linking service climate and customer perceptions of service quality: Tests of a causal model. *Journal of applied Psychology, 83,* 150.

Schuler, R. S., & Jackson, S. E. (1987). Linking competitive strategies with human resource management practices. *The Academy of Management Executive, 1,* 207-219.

Shipton, H., Fay, D., West, M., Patterson, M., & Birdi, K. (2005). Managing people to promote innovation. *Creativity and innovation management, 14,* 118-128.

Subramaniam, M., & Venkatraman, N. (2001). Determinants of transnational new product development capability: Testing the influence of transferring and employing tacit overseas knowledge. *Strategic Management Journal, 22,* 359-378.

Subramaniam, M., & Youndt, M. A. (2005). The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal, 48,* 450-463.

Takeuchi, R., Chen, G., & Lepak, D. P. (2009). Through the looking glass of a social system: Cross-level effects of high-performance work systems on employees' attitudes. *Personnel Psychology, 62,* 1-29.

Takeuchi, R., Lepak, D. P., Wang, H., & Takeuchi, K. (2007). An empirical examination of the mechanisms mediating between high-performance work systems and the performance of Japanese organizations. *Journal of Applied Psychology, 92,* 1069.

Thompson, M., & Heron, P. (2006). Relational quality and innovative performance in R&D based science and technology firms. *Human Resource Management Journal, 16,* 28-47.

Tsai, W. (2001). Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. *Academy of management journal, 44,* 996-1004.

Yuan, F., & Woodman, R. W. (2010). Innovative behavior in the workplace: The role of performance and image outcome expectations. *Academy of Management Journal, 53,* 323-342.

Van Der Vegt, G. S., Van de Vliert, E., & Huang, X. (2005). Location-level links between diversity and innovative climate depend on national power distance. *Academy of Management Journal, 48,* 1171-1182.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal, 5,* 171-180.

West, M. A. (1990). The social psychology of innovation in groups. In M. A. West & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies* (pp. 309-333). Chichester, England: Wiley.

West, M. A. (2002). Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups. *Applied Psychology, 51,* 355-387.

Wright, P. M., McMahan, G. C., & McWilliams, A. (1994). Human resources and sustained competitive advantage: a resource-based perspective. *International journal of human resource management, 5,* 301-326.

Yuan, F., & Woodman, R. W. (2010). Innovative behavior in the workplace: The role of performance and image outcome expectations. *Academy of Management Journal, 53,* 323-342.

Zacharatos, A., Barling, J., & Iverson, R. D. (2005). High-performance work systems and occupational safety. *Journal of Applied Psychology, 90,* 77.

Zhou, J., & Shalley, C. E. (2003). Research on employee creativity: A critical review and directions for future research. *Research in personnel and human resources management, 22,* 165-218.

Zohar D. (2000). A group-level model of safety climate: Testing the effect of group climate on microaccidents in manufacturing jobs. *Journal of Applied Psychology, 85,* 587–596.

APPENDIX

Table 1. HPWS items

Ability-enhancing HR practices	Extensive investment on training
	Availability of different kinds of training
	Extensive training for general skills
	Very extensive selection efforts
	Focus on long-run employee potential
	High selection criteria in firm
	Great effort to select right person
	Great amount of money spent selection
Motivation-enhancing HR practices	Performance appraisal for personal development
	Close tie of pay to organizational performance
	A wage level higher than competitors
	Close tie of pay to department's performance
	Wide range in pay within same job grade
Opportunity-enhancing HR practices	Engagement in problem-solving and decisions
	Extensive transference of tasks & responsibilities
	Providing chances to use personal initiative
	Permitting enough discretion in doing work
	Participation in very wide range of issues
	Provides job rotation opportunities
	Provides an opportunity to work with different departments

Table 2. Means, Standard Deviations, and Correlations of Unit-level Variables

Variables	Mean	s.d.	1	2	3	4	5
1. HPWS	3.38	.45					
2. Innovation performance	20.12	62.94	0.23*				
3. Innovative climate	3.70	.54	0.49*	0.19*			
4. Size	59.07	82.77	0.16*	0.38*	0.08		
5. R&D intensity	.10	.16	0.00	-0.02	-0.04	0.03	
6. Age	14.40	8.90	0.07	0.03	0.00	0.34*	-0.11

N=164, * p<0.05

Table 3. Results of Regression Analysis Predicting Innovative Climate and Innovation Performance

	Innovative climate		Innovation performance		
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Size	.001	.001	.009**	.008**	.008**
Age	-.004	-.005	.022	.018	.018
R&D intensity	-.164	-.169	.219	.045	.002
Industry	Included	Included	Included	Included	Included
Innovative climate			.438	.118	.153
HPWS		.553**		.770*	.660*
HPWS * Climate					1.189**
Constant	3.837	1.974	.967	-.570	-1.354
Log likelihood			-543.016	-540.717	-536.291
R-square	.124	.310	.065	.069	.077
Δ R-square		.186**		.004*	.008**

N=164, ** p<0.01, * p<0.05 (Two-tailed tests)

Table 4. Mean, Standard Deviations, and Correlations of Multi-level Variables

Variables	Mean	s.d.	1	2	3	4	5	6	7	8
Individual-level										
1. Creativity	3.57	.55								
2. Gender	.16	.36	-0.10							
3. Age	33.53	5.89	-0.08	-0.27*						
4. Tenure	5.17	4.71	-0.08	-0.11*	0.65*					
Unit-level										
5. HPWS	3.24	.45	-0.12*	0.03	-0.05	-0.09				
6. Innovative climate	3.68	.55	-0.06	0.09	-0.04	-0.10	0.56*			
7. Size	55.68	69.34	-0.02	-0.07	-0.05	-0.06	0.34*	0.17*		
8. R&D intensity	.13	.17	0.09*	-0.05	0.03	-0.07	0.18*	0.08	0.15*	
9. Age	11.77	6.69	-0.06	0.01	-0.08	-0.14*	0.12	-0.28*	0.34*	-0.05

N = 57 at unit level, n =332 at individual level, * $p<0.05$

Table 5. Results of HLM Predicting Individual Creativity

	Individual creativity		
VARIABLES	Model 1	Model 2	Model 3
Individual-level			
Gender	-.178**	-.171*	-.138*
Age	.018*	.018*	.019*
Tenure	-.023*	-.024*	-.030**
Unit-level			
Size	.015	.001	-.024
Age	-.004	-.006	-.003
R&D intensity	.028	.162	.204
Innovative climate	.020	-.053	.153
HPWS		.169*	.111
HPWS * Climate			.300**
Constant	3.030**	2.815**	2.777**
Deviance	528.639	526.980	522.751
Δ Deviance		1.659*	4.229**

N = 57 at unit level, n =332 at individual level,

** p<0.01, * p<0.05 (Two-tailed tests)

Table 6. Results of Additional Analyses

	Team creativity			Innovation performance				
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Size	-.017	-.043	-.065	.950**	.675*	.599*	.749**	.677**
Age	-.005	-.006	-.006	.013	.0002	-.0004	.019	.013
R&D intensity	.344	.225	.284	.465	-.452	-.375	-1.695	-1.163
Industry	Included	Included	Included	Included	Included	Included	Included	Included
Innovative climate	.052	-.005	.044	.203	-.237	.053	.068	.167
HPWS		.170	.121		1.371*	.976	.932	.782
HPWS * Climate			.351*			1.753**		1.199
Unit creativity							2.410**	1.629*
Constant	3.456**	3.251**	3.197**	-1.514	-3.147	-3.625	-12.634**	-9.853
Log likelihood				-188.668	-186.818	-182.690	-182.428	-180.930
R-square	.291	.324	.405	.088	.097	.117	.118	.125
Δ R-square		.033	.081*		.009*	.020**	.021**	.009*

N=57, ** p<0.01, * p<0.05 (Two-tailed tests)

Figure 1. Theoretical Model

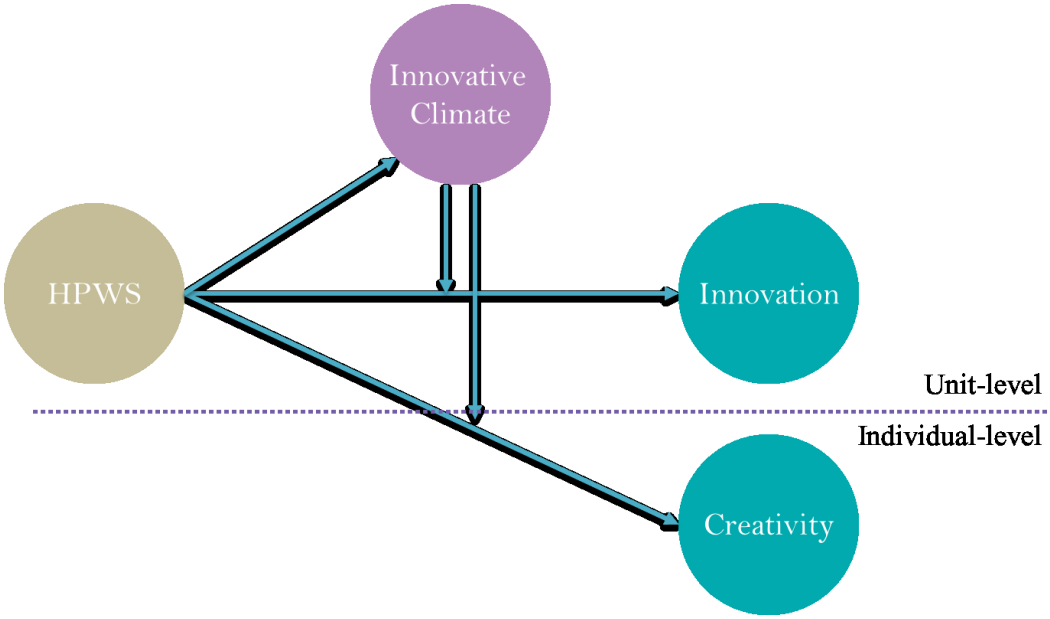

Figure 2. Effects of Interaction between HPWS and Innovative Climate on Innovation

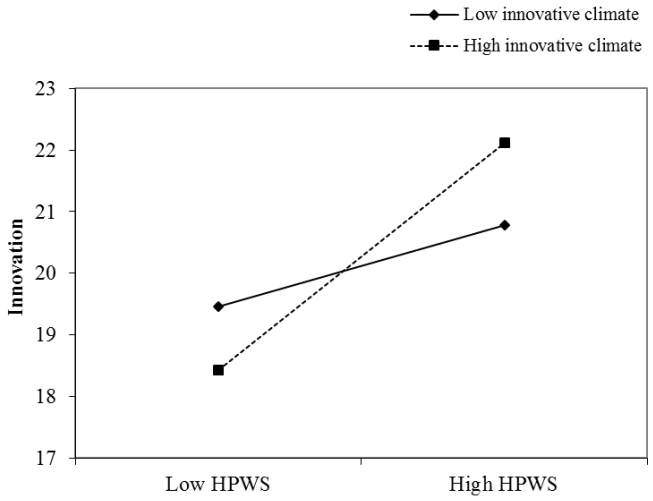

Figure 3 Effects of Interaction between HPWS and Innovative Climate on Creativity