1-1-2003

Strategic Compensation: Does Business Strategy Influence Compensation in High-Technology Firms?

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Abstract
This study examined whether a firm's business strategy influences the firm's compensation systems in high-technology firms. For the firm strategy variable, we used innovation strategy, which is one of the most critical business strategies in the high-technology industry. Our analysis showed that a firm's emphasis on innovation is positively related to the firm's employee pay level, both short-term pay and long-term pay. Moreover, a firm's emphasis on innovation has significant influence on several other aspects of employee compensation management. Innovation is positively associated with the difference in pay level between R&D employees and other employees, time orientation of employee compensation (the relative emphasis on long-term pay to short-term pay), and the length of the stock option vesting period. The influence of innovation is significant after controlling for industry membership.

Keywords
organization, performance, practices, research, firm, industry, innovation, compensation, employee, pay, R&D

Disciplines
Human Resources Management

Comments
Suggested Citation
Yanadori, Y. & Marler, J. H. (2003). *Strategic compensation: does business strategy influence compensation in high-technology firms?* (CAHRS Working Paper #03-03). Ithaca, NY: Cornell University, School of Industrial and Labor Relations, Center for Advanced Human Resource Studies.
http://digitalcommons.ilr.cornell.edu/cahrswp/26/

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WORKING PAPER SERIES

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Working Paper 03 – 03

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January, 2003

ABSTRACT

This study examined whether a firm's business strategy influences the firm's compensation systems in high-technology firms. For the firm strategy variable, we used innovation strategy, which is one of the most critical business strategies in the high-technology industry. Our analysis showed that a firm's emphasis on innovation is positively related to the firm's employee pay level, both short-term pay and long-term pay. Moreover, a firm's emphasis on innovation has significant influence on several other aspects of employee compensation management. Innovation is positively associated with the difference in pay level between R&D employees and other employees, time orientation of employee compensation (the relative emphasis on long-term pay to short-term pay), and the length of the stock option vesting period. The influence of innovation is significant after controlling for industry membership.

ACKNOWLEDGEMENT

The support of Clark/Bardes, particularly Joe Rich and Beth Florin, is gratefully appreciated. The authors also would like to thank George Milkovich for his helpful comments and suggestions.

Strategic Compensation: Does Business Strategy Influence Compensation in High-Technology Firms?

A strategic perspective on compensation management claims that a firm's compensation system should be tailored such that it supports the firm's business strategy (Milkovich & Newman, 2002). Its premise is that good fit, or alignment, between a firm's business strategy and its human resource management system, including the compensation system, leads to better firm performance (e.g., Gerhart, 2000). Given this premise, both researchers and practitioners suggest that a firm's business strategy should be a key determinant of the firm's compensation system. Consequently, firms pursuing different business strategies develop different compensation systems. Indeed, Gerhart and Milkovich (1990) reported that firms' pay systems (e.g., pay level, pay mix) were different even after controlling for employee human capital (e.g., education, tenure) and firm characteristics (e.g., size, profitability, industry), and moreover, the differences were stable across time.

There is much anecdotal and prescriptive information concerning which business strategy fits better with which compensation system. For instance, increasing variable pay portion is supposed to be a more appropriate compensation strategy for firms that pursue a competitive advantage through cost efficiency because the pay scheme helps the firms control their labor costs (e.g. Milkovich & Newman, 2002). Ellig (1981) argues that a firm's compensation system should change according to the firm's change in market cycle. The empirical evidence on such relationships, however, is still evolving. Pitts (1976) confirmed that diversified firms were more likely to link employee pay with business unit performance, whereas less diversified firms were more likely to link employee pay with corporate performance. Several studies have reported that a certain combination of a firm's business strategy and pay system leads to better organization performance (e.g., Gomez-Mejia & Balkin, 1992; Montemayor, 1996; Rajagopalan, 1996). Yet the evidence is still equivocal in support of any systematic relationship between a certain business strategy and a particular compensation system. The paucity of research is particularly evident in relation to high-technology firms, which play a key role in the U.S. economy.

The purpose of this study is the investigation of such systematic relationships in high-technology firms. Using non-executive employees' compensation data from about 250 organizations in the high-technology industry, we examine whether a certain business strategy is associated with several dimensions of compensation strategy. In this study, we focus on innovation strategy, which is one of the most critical business strategies for high-technology firms (Balkin, Markman, & Gomez-Mejia, 2000; Hill & Snell, 1988). Building on Balkin et al. (2000), who reported a positive relationship between a firm's emphasis on innovation and the size of CEO pay in high-technology firms, this study examines the pay for non-executive employees. We will show that the influence of innovation strategy on compensation goes beyond CEO pay. Non executive-level employee compensation is also influenced by innovation strategy in high-technology firms.

Furthermore, while Balkin et al. (2000) focused on pay level, our study examines the effects of a firm's innovation strategy on several dimensions of the firm's total compensation strategy. To do this, we investigate not only pay level, but also internal pay structure (i.e., the differences in pay level across different employee groups), pay mix, and the design of each pay form. As suggested by Gerhart (2000), looking at multiple dimensions of compensation management will more accurately describe the array of a firm's compensation decisions. It is notable that some of these dimensions have been quite underdeveloped. Specifically, we introduce "time orientation" of employee compensation, a new concept in pay mix, which refers to the relative emphasis on long-term pay to short-term pay. We will argue that this measure is relevant particularly when we examine the relationship between innovation strategy and employee compensation in high-technology firms. Concerning pay plan designs, we examine the lengths of the stock option vesting period. Given the limited research on stock option vesting periods, our investigation of the determinants of vesting period lengths contributes to our knowledge in compensation management.

We also incorporate possible effects of institutional factors. Relying on institutional theory (DiMaggio & Powell, 1983; Tolbert & Zucker, 1996), we examine whether a firm's compensation system is influenced by institutionalized norms within an industry. Specifically, we test whether a firm's pay mix policy and the length of the vesting period of stock options are shaped by market industry competitors' practices. Our "high-technology firms" dataset consists of firms in several sub-industries (e.g., computer hardware, semi-conductor, computer software). We show that the membership of these sub-industries needs to be taken into account when we investigate a firm's choice of compensation strategies.

This study leverages the multi-level nature of our data. Our compensation data includes detailed non-executive-level, individual employee compensation information from firms in the high-technology industry. We merge firm information (e.g., size, performance, innovation strategy) and industry membership with our compensation data. It allows us to analyze the effects of a firm's business strategy on employee compensation from three different levels: individual-level, firm-level, and industry-level. We use hierarchical linear models with three levels for our hypothesis testing.

THEORY AND HYPOTHESES

High-Technology Firms and Innovation Strategy

According to Porter (1980), to effectively compete in the market, firms must position themselves appropriately. Porter suggested that there are three major types of positioning: cost leadership, product differentiation, and focus. Among these, product differentiation seeks a competitive advantage by providing unique values to customers that competitors cannot. A technological innovation, which often results in the generation of new products, obviously enables firms to provide customers additional value. Hence, emphasizing innovation can be regarded as one effective differentiation strategy. In addition, emphasis on the innovation strategy may support firms that use cost leadership strategy, too. This strategy pursues a competitive advantage through continuous cost reduction. Innovation in production will substantially lower a firm's production cost, which gives the firm a competitive cost advantage. Pursuing an innovation strategy, therefore, is an effective way to successfully position a firm's products in Porter's framework.

A decade later, the resource-based view of the firm (Barney, 1990) claimed that the resources that are valuable, rare, inimitable, and substitutable can be a source of sustained competitive advantage. Because being technologically innovative potentially satisfies all four criteria (Arora, Fosfuri, & Gambardella, 2001; Balkin et al, 2000), a firm's effort to acquire such innovative capability is a legitimate firm activity to compete in the market. Being innovative is effective particularly for firms in the high-technology industry (Hill & Snell, 1988). Successful new product development results in high profit margin. New products often create a whole new market, which the inventor can exploit until its competitors catch up to its technology. Even when the competitors catch up, the inventor will be able to enjoy the revenue from licensing new technologies (Arora et al, 2001).

Given that innovation strategy is one promising strategic direction for firms in the high-technology industry, the most straightforward action for firms that pursue innovation strategy is to increase their R&D investments, which should improve the firm's technological advantage. To exploit the positive effects of R&D investments, the firm’s management practices must support its strategic decision making. The management that believes that HR practices need to support the firm's business strategy will tailor the firm's HR practices accordingly. Consequently, the differences in a firm's orientation to R&D will lead to differences in the firm's HR practices, including compensation practices.

Pay Level

Balkin et al. (2000) reported that a firm's innovation strategy had positive effects on the firm's CEO compensation, both short-term (i.e., salary and bonus) and long-term pay. Although innovation strategy has the potential to enable increased profitability, it is inherently risky because the investment for developing new products is not always successful (Baysinger, Kosnik, & Turk, 1991). Given an agency theory assumption that agents (or CEOs) are risk-averse (Eisenhardt, 1988; Wiseman, Gomez-Mejia, & Fugate, 2000), agents will be less willing to make R&D investments, which increase their level of risk, considering the likelihood of unsuccessful investments. In contrast, R&D investments are more attractive to principals (or stockholders), who are less risk-averse (Baysinger et al., 1991). Moreover, for principals of high-technology firms, R&D investments are critical for gaining a competitive advantage, and thus they try to set a compensation system that motivates their CEOs to commit to R&D investments. Accordingly, Balkin et al. (2000) argued that the level of CEO compensation should be associated with a firm's commitment to innovation including R&D investments. Their statistical analyses using CEO compensation data in 1993 and 1994 supported their argument. A firm's commitment to innovation had significant positive effects on the level of CEO short-term and long-term pay.

We argue that a similar rationale can be applied to managers below the CEO. Both the CEO and shareholders will want to provide the same incentives to non-executive employees. Stockholders, who want to increase R&D expenditure for strengthening their firm's future technological advantage may opt to arrange the non-executive employee compensation system such that it encourages consistent support for the increase in R&D investments among non-executive employees. In addition, given the significant positive relationship between a firm's innovation strategy and the CEO's compensation, the CEO may be motivated to strengthen the link between a firm's innovation strategy and non-executive employee pay level because it encourages its non-executive employees to support the CEO's decision to increase R&D spending, which eventually increases the CEO’s pay.

However, the effect of increased R&D investments on firms’ performance variability, employees' income risk, and employment stability may motivate employees to behave in unanticipated ways that are in fact undesirable for the firm (Bloom & Milkovich, 1998). To offset increasing risk, one compensation scheme to alleviate the situation is to pay risk premiums. Increasing employee pay level (i.e., providing risk premiums) compensates for the employees' increased income and employment risk. Consequently, a firm's innovation strategy will have a positive effect on the pay level for non-executive employees in high-technology firms.

Hypothesis 1: Innovation strategy has a positive effect on non-executive employee pay level in high-technology firms.

Pay Structure

Pay structure is defined as "the array of pay rates for different work or skills within a single organization." (Milkovich & Newman, 2002: 59) Although past researchers have been interested in the differences in pay level across job levels (e.g., Bloom, 1999), it also includes the difference in pay among employees in different job families (e.g., Pfeffer & Davis-Blake, 1987). This study focuses on the difference in pay level between job families.

Resource dependence theory (Pfeffer & Slancik, 1978) argues that organization decisions are influenced by both internal and external agents that control critical resources for the organizations. According to this theory, organizations must acquire resources (e.g., money, technology, accreditation from regulatory agencies) to survive, and they interact with other actors who control such resources. The actors who control such resources, either internally or externally, have considerable influences over the organizations. With regard to internal agents, certain positions are more important because they secure valuable resources, and research shows that employees holding such positions are paid more (Pfeffer & Davis-Blake, 1987;

Pfeffer, Davis-Blake, & Julius, 1995). For instance, Pfeffer and Davis-Blake (1987) show that officers who play an important role in raising money (e.g., chief development officer, admissions director) are paid comparatively more in private academic institutions than in public academic institutions. In contrast, the officers that play an important role in maintaining a good relationship with the community (e.g., director of community services, chief public relations officer) are paid more in public academic institutions. More recently, Carpenter and Wade (2002) researched the interaction between executives' functional position, their firms' strategic resource allocation, and cash compensation for the executives. They found that the relative cash pay level of executives in R&D increased as their firms' allocated more resources to R&D.

In high-technology firms that pursue a competitive advantage through innovation, the most important resource is the ability to produce innovative outcomes. Compared to other employees, those in R&D positions are obviously a key resource. They have the potential to make the greatest contribution to the firm's success. The importance of R&D employees, as compared with other groups, increases as the firm's emphasis on innovation increases. Consequently, the difference in pay level between R&D employees and other employee groups will increase as the firm increases R&D investments.

> *Hypothesis 2: Innovation strategy moderates the relationship between employee group and employee pay level in high-technology firms such that the greater the emphasis on innovation, the greater the difference in pay level between R&D employees and other employee groups.*

Pay Mix

Pay mix, which is defined as "relative emphasis among compensation components" (Milkovich & Newman, 2002: 664), is an important dimension of compensation strategy (Gerhart, 2000; Gerhart & Milkovich, 1990). A review of past pay mix studies shows that virtually all studies are based on agency theory, and examine the proportion of one pay form, variable pay (e.g., the ratio of bonus to base pay, the ratio of long-term incentives to total pay, etc.) across managerial compensation packages (e.g., Anderson, Banker, & Ravindran, 2000; Werner & Tosi, 1995). In this study, however, we examine another more relevant pay mix concept, "time orientation," which refers to the relative emphasis on long-term pay in employee compensation packages as compared with short-term pay. Some pay forms are based on short-term results (e.g., merit pay, annual bonus), while other pay forms are based on long-term outcomes (e.g., stock options, stock grants). Agency theory (Eisenhardt, 1989; Jensen & Meckling, 1976) and expectancy theory (Vroom, 1964) argue that employees maximize their utility by focusing not only on the amount of incentives, but also on the criteria for earning it. Thus, compensation criteria that place greater emphasis on long-term pay, as compared with short-term pay, will motivate behavior and align the interest of employees to achieve long-term performance goals more than short-term performance goals.

The concept of time orientation is relevant to our investigation of the relationship between a firm's innovation strategy and employee compensation mix because it takes many years for the firms to actualize benefits from their investments on R&D. An innovation strategy may require maximizing long-term profitability by sacrificing short-term performance (David, Hitt, & Gimeno, 2001). Thus, compensation time frames need to reflect these important differences or else risk invoking inconsistent employee behaviors (Hoskisson, Hitt, & Hill, 1993). Consequently, we hypothesize that a firm's innovation strategy is positively associated with long-term time orientation of employee compensation.

Hypothesis 3: Innovation strategy has a positive effect on time-orientation of employee compensation in high-technology firms.

Stock Option Plan Design

This study argues that a firm's innovation strategy also influences the design of each pay plan. One relevant pay plan design to a firm's innovation strategy is the length of stock option vesting period. Vesting period refers to "the amount of time it takes for an option to become exercisable" (National Center for Employee Ownership, 1998). Recipients of stock options usually have to wait a certain number of years before exercising options. Because recipients can benefit financially only after exercising options, the vesting period shifts recipients' attention to firm performance beyond the vesting period. The longer the vesting period, the longer the time frame of stock options. The survey by NCEO (2001) shows that vesting periods range generally from one year to seven years. Four years is the most common vesting period both for management and non-management. To our knowledge, no study has ever investigated the determinants of the length of the stock option vesting period.

The discussion on the relationship between innovation strategy and stock option vesting period length is essentially the same as the previous section, which claims that the relationship between innovation strategy and time orientation of employee compensation must be consistent. We argue that innovation strategy will be executed effectively when the interests of employees are aligned with their firms' long-term performance. Consequently, the emphasis on innovation should be associated with stock option plan designs that feature a longer vesting period.

Hypothesis 4: Innovation strategy has a positive effect on the length of the vesting period of stock options in high-technology firms.

Institutional Factors

While we hypothesize that a firm's business strategy influences the firm's compensation strategy, theory and evidence suggest that firms also consider their competitors' behaviors. Institutional theory (Meyer & Rowan, 1977; DiMaggio & Powell, 1983) argues that organizations adopt a prevailing structure even if it is not necessarily the most effective, or if it does not fit with the organizations' business strategy or external environment. This is because the adoption of popular practices enables the organizations to enhance their legitimacy, which reduces uncertainty and secures resources necessary for their survival. Researchers have applied this theory in explaining the diffusion of particular human resource practices (Wright & McMahan, 1994). Westphal and Zajac (1994) examined the adoption of long-term incentive plans for corporate executives from 1971 through 1990. Barringer and Milkovich (1998) suggested that institutional theory would explain the adoption of flexible benefits.

Because the process of institutionalization includes organization comparison with its product market competitors (Tolbert & Zucker, 1996), the extent to which a certain practice is adopted and institutionalized varies across product market industries. Indeed, Eisenhardt (1989) reported that the use of sales commission was more common in shoe sales than in other segments of the retailing industry. Consequently, the adoption of various pay forms, the design of each pay form, and the mix of different pay forms may also reflect the institutionalized shared norm among industries. While our dataset includes firms in the high-technology industry, the industry is made up of several sub-industries (e.g., computer hardware, semiconductor, computer software), which are regarded as independent. We claim that compensation strategies that comprise decisions on pay level, pay structure, pay mix, and design of each pay plan are influenced by these sub-industry memberships even after controlling for a firm's business strategy, size, performance. This is not to say that firms in the same industry subset choose an identical compensation strategy. Our intention is to demonstrate that both a firm's business strategy and industry membership simultaneously influence the firm's compensation strategy. While compensation strategies are relatively similar among firms in the same sub-industry, firms within a sub-industry still exhibit significant differences in their compensation strategies reflecting their business strategy.

Labor economists have already shown industry differences in pay level (e.g., Kreuger & Summers, 1988), here we posit that compensation strategy, which also encompasses pay mix and pay plan design, is influenced by industry membership.

Hypothesis 5a: Industry membership has an influence on the time-orientation of employee compensation even after controlling for innovation strategy and other relevant organization characteristics.

Hypothesis 5b: Industry membership has an influence on the length of the vesting period of stock options after controlling for innovation strategy and other relevant organization characteristics.

METHODS

Data

The data was obtained from SC/ChiPS' annual compensation survey, compiled by *Clark/Bardes*, a compensation consulting firm formerly know as *Executive Alliance*. The database contains individual employees' compensation data as well as information on employees' jobs, job levels, tenure, and office locations for more than 100 companies in the high-technology industry (e.g., computer hardware, computer software, telecommunications) for the years from 1997 to 2000. While some firms participated in the survey all four years, others participated in the survey only three years or less. Despite both public and private firm participation in the survey, the scope of this study is limited to public firms due to the difficulty of collecting firm-level information (e.g., firm size, performance) on private firms. We also collected firm-level information from Standard & Poor's COMPUSTAT. Our data collection effort yielded about 980,000 non-executive employees in 259 firm-years (47 firms for 1997, 63 for 1998, 65 for 1999, and 84 for 2000).

Dependent Variables

To test our hypotheses, we use three dependent variables: pay level, time orientation of employee compensation, and the length of the stock option vesting period. We use *total pay*, *short-term pay* and *long-term pay*. *Total pay* includes virtually all forms of monetary (e.g., base pay, profit sharing awards) and non-monetary compensation (e.g., stock options, medical insurance, perquisites, and other benefits). Monetary values of employee benefit plans represent hypothetical values that an employee would need to purchase equivalent plans in the marketplace. We use *short-term pay* and *long-term pay* as the dependent variable measures of pay level to see whether there are any differences in the effect of innovation strategy on the levels of these two pay categories whose time orientation is different. *Short-term pay* includes base pay, profit-sharing award, and other short-term incentives (i.e., cash award related to annual corporate, division, unit or individual performance). Base pay is regarded as *short-term* pay since it is revised annually or more frequently based on short-term performance and increased skill. *Long-term pay* includes various long-term incentive plans (e.g., stock options, stock grants). *Total pay* is described as the sum of *short-term pay*, *long-term pay*, and various employee benefit plans. These definitions of *short-term pay* and *long-term pay* are consistent with Balkin et al. (2000). Since our dataset includes compensation data collected from different years (i.e., 1997-2000), the rate of inflation was adjusted using the Consumer Price Index (CPI). *Time orientation* of employee compensation is measured as the ratio of *long-term pay* to *short-term pay* (in percent). *Vesting period* is measured in the number of years. As the distributions of *total pay*, *short-term pay*, *long-term pay*, and *time orientation* are skewed, we apply logarithmic transformation.

Independent Variables

Innovation strategy. We use each firm's R&D intensity as a proxy of innovation strategy. R&D intensity is calculated as R&D expenditure (in dollars) divided by the number of employees (Baysinger, et al. 1991). While Balkin et al. (2000) used a composite measure computed by adding standardized value of R&D spending and number of patents, R&D per employee is generally regarded as the best proxy for a firm's emphasis on innovation (Hill & Snell, 1988; Scherer, 1984). The rate of inflation is adjusted using the CPI. As the distribution of this variable is skewed, we also apply logarithmic transformation.

Industry membership. Firms self-reported their industry membership based on a categorization supplied by *Clark/Bardes*. There are 12 subsets of industry in our dataset, which are: computer hardware, semiconductor, PC software, peripheral, communications, defense, applied special services, consumer electronics, telecommunication services, storage, manufacturing equipment, and others.

Control Variables

We include several relevant control variables. They are either individual- or firm-level variables.

Individual-level variables. The first individual-level control variable is job family**.** Our dataset provides three categories of job family: research and development (R&D) jobs, technical jobs, and administrative jobs. R&D jobs include semiconductor engineers, CAD engineers, and development engineers. Technical jobs include business systems analysts, data base specialists, and application programmers. Administrative jobs include finance, legal, and human resources. *R&D job* is measured by an indicator variable; 1 if an employee holds an R&D job and 0 otherwise. We also control for employee job level. There are eight job levels based on the scope of jobs and their responsibility. Levels 1-5 are individual contributors, and levels 6-8 are managers. The higher the number, the higher the job level. Finally, we include employee tenure. It is shown in years in the job.

Firm-level variables. Firm-level information is collected from Standard & Poor's COMPUSTAT. First we include *firm size* as a control variable. Researchers agree on the positive relationship between firm size and pay level (Ehrenberg & Smith, 2002). Concerning pay mix, Zenger and Marshall (2000) reported that bigger firms were less likely to use group-based incentives. We use the number of employees of the firm for the proxy. We also include *firm performance*. More profitable firms may be able to pay more. In terms of pay mix, Marler, Milkovich, and Yanadori (2002) reported that firm performance was positively associated with the relative importance of stock options. We use return on assets (ROA) to measure *firm performance*. In addition, we include each firm's *stock market price*. *Stock market price* may have some influences on the firm's stock option decisions (e.g., how many options should be granted, and vesting period). We use each firm's closing stock price in the calendar year. Finally, we include a firm's *cash flow*. Since stock options do not require contemporaneous cash payment, firms that are short of cash flow may be motivated to use stock options. *Cash flow* is calculated as: (income before extraordinary items plus depreciation and amortization) / (common shares used to calculate earnings per share multiplied by adjustment factor) (Standard & Poors, 1994). With regard to *firm size, stock market price, and cash flow*, the rate of inflation is adjusted using the CPI. As the distribution of *firm size* is skewed, we apply logarithmic transformation.

Model

Due to the multi-level structure of our dataset, we use hierarchical linear model (Littell, Milliken, Stroup & Wolfinger, 2000; Singer, 1998) to test our hypotheses. The general model is:

$$Y_{ijk} = \beta_{jk} X_{ijk} + \varepsilon_{ijk} \text{ (level 1 - Individual)}$$
$$\beta_{jk} = \gamma_k Z_{jk} + U_{jk} \text{ (level 2 - Firm)}$$
$$\gamma_k = \tau + V_k \text{ (level 3 - Industry),}$$

where *ijk* means employee *i* in firm *j* in industry *k*. Y_{ijk} are the dependent variable measures for individual *i* in firm *j* in industry *k*. X_{ijk} is a matrix of individual-level independent variables and Z_{jk} is a matrix of firm-level independent variables. β_{jk} and γ_k are predictors. [i] τ is the industry mean of γ_k. U_{jk} is a firm-level random effect, and V_k is an industry-level random effect. ε_{ijk} is an error term. U_{jk}, V_k, and ε_{ijk} are all assumed to be iid-normal with means 0's and their variances are δ^2_U, δ^2_V, and δ^2_ε. We do not include a year variable because our preliminary analysis shows that the data year does not have a significant effect. For firm-level independent variables (Z_{jk}), we took a one-year lag. For instance, we estimate *Total pay*$_{ijk}$ in year *t* using individual-level information in year *t* and firm-level information in year *t-1*. More specifically, we use the following model.

$$(\text{Dependent variable})_{ijk} = \beta_{0jk} + \beta_{1jk} (\text{R\&D Job})_{ijk} + \beta_2 (\text{Job level})_{ijk} + \beta_3 (\text{Tenure})_{ijk} + \varepsilon_{ijk}$$
$$\beta_{0jk} = \gamma_{00jk} + \gamma_{01jk}(\text{Firm size})_{jk} + \gamma_{02jk}(\text{Firm performance})_{jk} + \gamma_{03jk}(\text{Stock market price})_{jk} + \gamma_{04jk}(\text{Cash flow})_{jk} + \gamma_{05jk}(\text{Innovation})_{jk} + U_{0jk}$$
$$\beta_{1jk} = \gamma_{10jk} + \gamma_{11jk} (\text{Innovation})_{jk} + U_{1jk}$$
$$\gamma_{00jk} = \tau + V_{00k},$$

where *total pay*, *short-term pay*, and *long-term pay* are used as the dependent variables for Hypothesis 1 and 2, *time orientation* is used for Hypothesis 3 and 5a, and *vesting period* is for

Hypothesis 4 and 5b. For testing Hypothesis 1, we examine whether γ_{05jk} is positive and significant. For testing Hypothesis 2, we examine whether γ_{11jk} is significant and positive. For Hypothesis 3 and 4, we test whether γ_{05jk} is positive and significant. For Hypothesis 5b and 5b, we test whether V_{00k} is significantly different from zero.

RESULTS

Table 1 contains a summary of descriptive statistics for our variables, along with their intercorrelations. The results of our hierarchical linear model (HLM) analyses that estimate employee pay level are presented in Table 2. As already explained, we use three dependent variable measures: *short-term pay*, *long-term pay*, and *total pay*. For each dependent variable, we ran two models: one we consider the full model, as specified above; the other is the reduced model, which does not include the moderating effect of *innovation* on the relationship between *R&D job* and the three measures of pay level[ii]. We show results with two different models because we think that contrasting two models describes the moderation effect of *innovation* more accurately. The left columns of the two columns for each dependent variable show the results of reduced models, and the right columns show the results of full models.

The results clearly show that *innovation* has a significant positive effect on pay level in high-technology firms. The coefficients of *innovation* (γ_{05}) are all positive and significant. Therefore, Hypothesis 1, which stated that innovation strategy has a positive effect on non-executive employee pay level, is supported. Next, we focus on the results of full models displayed in the right columns of each dependent variable. The moderation effects of *innovation* on the relationship between *R&D job* and pay level (γ_{11}) are all positive and significant, which supports Hypothesis 2. When we compare the results of the full models (right columns) with those of the reduced models (left columns), we recognize that the signs of the effect of *R&D job* (β_{1j}) become negative in the full models, whereas they are positive in the reduced models. The results of the three reduced models suggest that employees holding R&D positions are paid more than the other employees in high-technology firms. However, once we take account of the moderation effect of *innovation* on the relationship between *R&D job* and pay level, we find that employees in R&D positions are paid less than the other employees. As far as total pay is concerned, the effect of *R&D job* turns to be positive when *innovation* is greater than 5.78 (= 0 - (-0.191 / 0.033); -0.191 is the coefficient for *R&D job* (β_{1j}) and 0.033 is the coefficient of the moderation effect (γ_{11})). In fact, none of the firms in our dataset has an *innovation* measure lower than 5.78. Therefore, the effect of *R&D job* is actually positive.

Table 1
Descriptive Statistics and Correlations

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9	10
1. Total pay*	4.73	0.41										
2. Short term pay*	4.36	0.32	0.86									
3. Long term pay*	1.24	1.74	0.71	0.37								
4. Time orientation*	-1.57	9.91	0.59	0.28	0.96							
5. Vesting period	4.17	0.92	0.12	-0.04	0.30	0.34						
6. R&D job	0.44	0.50	0.17	0.21	0.07	0.04	0.04					
7. Job level	3.57	1.60	0.69	0.78	0.27	0.20	-0.14	0.05				
8. Tenure	2.79	1.44	0.12	0.24	-0.12	-0.13	-0.27	-0.07	0.27			
9. Firm size*	11.00	1.31	-0.07	0.02	-0.27	-0.28	-0.11	0.01	-0.02	0.30		
10. Firm performance	11.49	1.69	0.19	0.03	0.35	0.35	0.48	0.35	-0.06	-0.20	-0.10	
11. Stock market price	49.62	23.23	0.08	-0.02	-0.07	-0.11	0.28	-0.02	-0.06	0.12	0.65	0.27
12. Cash flow	2.59	2.28	-0.18	-0.08	-0.28	0.35	-0.43	0.03	-0.03	0.21	0.53	-0.06
13. Innovation*	10.14	0.72	0.26	0.12	0.37	0.34	0.57	0.06	-0.01	-0.27	-0.40	0.33

1. N = 980,306. Correlations greater than | 0.002 | indicate $p < 0.05$.
2. * indicates the variables are in logarithm.

Table 2
Results of Hierarchical Linear Model Analysis on Pay Level

	Pay Level					
Dependent Variables	**Short-term pay (Base + Bonus)**		**Long-term pay**		**Total Pay**	
	Reduced Model	**Full Model**	**Reduced Model**	**Full Model**	**Reduced Model**	**Full Model**
(Individual-level variables)						
R&D Job (β_{1j})	0.136***	-0.130*	0.237***	-0.996**	0.135***	-0.191**
Job Level (β_{2j})	0.147***	0.147***	0.345***	0.347***	0.175***	0.176***
Tenure (β_{3j})	0.020***	0.020***	-0.030***	-0.033***	0.011***	0.011***
(Firm-level variables)						
Firm size (γ_{01})	0.013**	0.008*	-0.165**	-0.164**	-0.035***	-0.034***
Firm Performance (γ_{02})	0.000	0.000	0.000**	0.000*	0.000	0.000
Stock market price (γ_{03})	0.000	0.000	0.016***	0.016***	0.007***	0.007***
Cash Flow (γ_{04})	-0.002	-0.002	-0.059	-0.052	-0.024**	-0.023**
Innovation (γ_{05})	0.055***	0.044***	0.364**	0.321**	0.059**	0.047*
(Interaction)						
R&D job * Innovation (γ_{11})	-	0.027***	-	0.122***	-	0.033***
(Random Effects)						
Intercept – Firm (U_{ojk})	0.006***	0.006***	1.111***	1.001***	0.034***	0.030***
Intercept – Industry (V_{00k})	0.002***	0.002***	0.163***	0.159***	0.004***	0.004***
R&D job (U_{1j})		0.004***		0.140***		0.008***

n = 980,306.
*** p < .001
** p < .01
* p < .05

Table 3 describes the results of the HLM analyses that estimate *time orientation* of employee compensation and the length of the stock option *vesting period*. The left column is the result of the analysis on *time orientation*. The effect of *innovation* on time orientation (γ_{11}) is positively significant (p < 0.01), suggesting that innovation strategy increases the emphasis on long-term pay relative to short-term pay. This supports Hypothesis 3. The right column of Table 3 is the result of the analysis that estimates the length of the stock option *vesting period*. The effect of *innovation* (γ_{11}) is positively significant (p < 0.01), suggesting that innovation strategy has the effect of extending the length of the vesting period of stock options granted. This supports Hypothesis 4.

Finally, the random effect of industry (V_{00k}) is significant for *time orientation* and *vesting period* ($p < 0.001$ for both). It means that there are significant industry effects on the level of *time orientation* of employee compensation and the length of the stock option *vesting period* even after controlling for innovation strategy and other relevant factors. Therefore, Hypothesis 5a and 5b are supported.

Table 3
Results of Hierarchical Linear Model Analysis on Pay Mix and Stock Option Vesting Period Length

Dependent Variables	Time-orientation (Long-term pay/Short-term pay)	Vesting Period
(Individual-level variables)		
R&D Job (β_{1j})	-0.804***	-0.044
Job level (β_{2j})	0.293***	0.003***
Tenure (β_{3j})	-0.036***	-0.010***
(Firm -level variables)		
Firm size (γ_{01})	-0.178***	0.017
Firm performance (γ_{02})	0.000*	0.000***
Stock market price (γ_{03})	0.016***	-0.000
Cash flow (γ_{04})	-0.054	-0.159***
Innovation (γ_{05})	0.336**	0.305**
(Interaction)		
R&D job * Innovation (γ_{11})	0.099**	0.005
(Random Effects)		
Intercept - Firm (U_{ojk})	1.1915***	0.777***
Intercept - Industry (V_{00k})	0.164***	0.001***
R&D job (U_{1j})	0.141***	0.001***

n = 980,306.
*** $p < .001$
** $p < .01$
* $p < .05$

DISCUSSION

This study examined whether a firm's business strategy influences the firm's compensation systems in high-technology firms. For the firm strategy variable, we used innovation strategy, which is one of the most critical business strategies in the high-technology industry. Our analysis showed that a firm's emphasis on innovation is positively related to the firm's employee pay level, both short-term pay and long-term pay. Moreover, a firm's emphasis on innovation has significant influence on several other aspects of employee compensation management. Innovation is positively associated with the difference in pay level between R&D employees and other employees, time orientation of employee compensation (the relative emphasis on long-term pay to short-term pay), and the length of the stock option vesting period.

In addition, we confirmed distinct industry effects on different aspects of compensation management. The random effects of product market industry membership are all significant. The industry effect on pay level has been repeatedly reported. Scholars explain that it is attributed to differences in labor market and production technology that result in the difference in productivity across industry groups (Ehrenberg & Smith, 2003; Milkovich & Newman, 2002). In contrast, there has been little systematic study of industry differences in pay mix or the length of the stock option vesting period, which are more descriptive of compensation strategy than just pay level. Our hierarchical linear model (HLM) analyses showed that firms in the same industry segments tend to have similar levels of: (1) time orientation of employee compensation, and (2) the length of the stock option vesting period. These industry effects are significant even after controlling for other relevant economic and strategy variables. The findings are consistent with the institutional theory (DiMaggio & Powell, 1983; Meyer & Rowan, 1977) argument that organization structure becomes isomorphic. Using HLM, we demonstrated that both a firm's business strategy and industry membership simultaneously influence the firm's compensation strategy. Compensation strategies are relatively similar among firms in the same sub-industry;

nevertheless, these firms still exhibit significant differences in their compensation strategies reflecting their business strategies.

The robust effects of innovation strategy on several aspects of compensation management suggest that compensation managers do take account of their firms' business strategies when they develop their firms' compensation systems. As argued by "fit" perspective, good fit is supposed to be positively associated with firm performance. For example, we expect that the combination of innovation strategy and "longer time orientation" will improve firm performance in the high-technology industry. Our potential future research is to empirically confirm whether such combination really improves firm performance.

Although this study focuses on high-technology firms, a comparison of the effect of innovation strategy on several dimensions of compensation management across other industries may be interesting. Balkin et al. (2000) did find the effect of innovation on CEO pay level was significant only in high-technology firms; the effect was positive but not significant in non high-technology firms. Given this result, we suspect that innovation does not influence the pay level for non-executive employees in non high-technology firms. On the other hand, the relationship between innovation strategy and internal pay structure, pay mix, and the lengths of the stock option vesting period may be applicable to other industries. Hence, replicating our analysis with a different industry sample will strengthen our argument.

One caveat is that we focused on innovation strategy. We believe this is a reasonable strategy dimension in high-technology firms. Yet, it is not the only effective strategy, and the examination of the relationship between other business strategies and compensation management would be beneficial. This issue is perhaps particularly relevant to firms that are not in the high-technology industry. The task of exploring relevant business strategies is still an unresolved issue for compensation researchers (Gerhart, 2000).

Another issue that needs to be addressed is the time period in which the research is conducted. We use data from 1997 to 2000, when the U.S. economy exhibited remarkable performance, and so did high-technology firms. While our data is relatively recent as compared with other studies, in 2001 and after, the economy slowed substantially and many high-technology firms suffered significant financial and market value losses. Analyzing the compensation data from 2001 or after may provide us with different insights on compensation management.

Finally, when examining the effect of business strategy on employee pay mix, we introduced a new concept, "time orientation." When we looked at employee compensation from the viewpoint of fit with innovation, we believe that this pay mix dimension is more relevant than other conventional pay mix measures. To bolster this finding, replicating past studies using this time orientation measure would be useful.

Despite these caveats, our study confirms that high-technology firms develop their compensation systems considering both their innovation strategy and the observable strategies of their product market competitors. Expanding our research framework to other industries will substantially improve our knowledge of strategic compensation.

REFERENCES

Anderson, M. C., Banker, R. D., & Ravindran, S. 2000. Executive compensation in the information technology industry. *Management Science*, 46: 530-547.

Arora, A., Fosfuri, A., & Gambardella, A. 2001. *Markets for technology: The economics of innovation and corporate strategy*. Cambridge, MA, The MIT Press.

Balkin, D., Markman, G. D., & Gomez-Mejia, L. R. 2000. Is CEO pay in high-technology firms related to innovation? *Academy of Management Journal,* 43: 1118-1129.

Barney, J. 1991. Firm resources and sustained competitive advantage. *Journal of Management*, 17: 99-120

Barringer, M. W., & Milkovich, G. T. 1998. A theoretical exploration of the adoption and design of flexible benefit plans: A case of human resource innovation. *Academy of Management Review*, 23: 305-324.

Baysinger, B., Kosnik, R. D., & Turk, T. A. 1991. Effects of board and ownership structure on corporate R&D strategy. *Academy of Management*, 34: 205-214.

Bloom, M. 1999. The performance effects on pay dispersion on individuals and organizations. *Academy of Management Journal*, 42: 25-40.

Bloom, M., & Milkovich, G. T., 1998. Relationships among risk, incentive pay, and organizational performance. *Academy of Management*, 41: 283-297

Carpenter, M.A., & Wade, J. B. 2002. Micro level opportunity structures as determinants of non-CEO executive pay. *Academy of Management*, 45: 1085-1103

Core, J. E., & Guay, W. R. 2001. Stock option plans for non-executive employees. *Journal of Financial Economics*, 61: 253-287.

David, P., Hitt, M. H., & Gimeno, J. 2001. The influence of activism by institutional investors on R&D. *Academy of management Journal*, 44: 144-158.

DiMaggio, P. J., & Powell, W. W. 1983. The iron cage revisited: Institutional isomorphism and collective rationality in organization fields. *American Sociological Review*, 48: 147-160.

Ehrenberg, R. G., & Smith, R. 1997. *Modern labor economics: Theory and public policy* (8th ed.). Addison-Wesley.

Eisenhardt, K. M. 1988. Agency- and institutional-theory explanations: The case of retail sales compensation. *Academy of Management Journal*, 31: 488-511.

Ellig, B. 1981. Compensation elements: Market phase determines the mix. *Compensation Review*, Third quarter.

Gerhart, B. 2000. Compensation strategy and organizational performance. In S. Rynes & B. Gerhart (Eds.) *Compensation in organizations*. San Francisco, CA. Jossey-Bass.

Gerhart, B., & Milkovich, G. T. 1990. Organizational differences in managerial compensation and financial performance. *Academy of Management Journal*, 4: 663-691.

Gomez-Mejia, L. R., & Balkin, D. B. 1992. *Compensation, organizational strategy, and firm performance*. Cincinnati, OH: South-Western.

Hill, C. W., & Snell, S. A. 1988. External control, corporate strategy, and firm performance in research intensive industries. *Strategic Management Journal*, 9: 577-590.

Hoskisoon, R. E., Hitt, M. A., & Hill, C. W. 1993. Managerial incentives and investment in R&D in large multiproduct firms. *Organization Science*, 4: 325-341.

Jensen, M., & Meckling, W. H. 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 4: 305-360.

Kruger, A. B., & Summers, L. H. 1988. Efficiency wages and the inter-industry wage structure. *Econometrica*, 56: 259-293.

Little, R. C., Miliken, G. A., Stroup, W. W., & Wolfinger, R. D. 2000. *SAS system for mixed models*. Cary, NC: SAS Institute.

Marler, J. H., Milkovich, G. T., & Yanadori, Y. 2002. Organization-wide broad-base incentives: Rational theory and evidence. *Best paper proceedings*. Academy of Management.

Meyer, J. W., & Rowan, B. 1977. Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology*, 83: 340-363.

Miles, R. E., & Snow, C. C. 1978. *Organizational strategy, structure, and process*. New York: McGraw-Hill.

Milkovich, G. T. 1988. A strategic perspective on compensation management. In Ferris (Ed.) *Research in Personnel and Human Resource Management*, 6: 263-288. Greenwich, CT.

Milkovich, G. T., & Newman, J. 2002. *Compensation* (7th ed.). Homewood, IL: Irwin.

Montemayor, E. F. 1996. Congruence between pay policy and competitive strategy in high-performing firms. *Journal of Management*, 22: 889-908.

National Center for Employee Ownership. 1998. *Current practices in stock option plan design*. Oakland, CA.

National Center for Employee Ownership. 2001. *Current practices in stock option plan design*. Oakland, CA.

Pitts, R. A. 1976. Diversification strategies and organizational policies of large diversified firms. *Journal of Economics and Business*, 8: 181-188.

Pfeffer, J., & Davis-Blake, A. 1995. Understanding organizational wage structures: A resource dependence approach. *Academy of Management Journal*, 30: 437-455.

Pfeffer, J., Davis-Blake, A., & Julius, D. J. 1995. AA officer salaries and managerial diversity: Efficiency wage or status? *Industrial Relations*, 34: 73-94.

Pfeffer, J., & Salancik, G. R. 1978. *The external control of organizations: A resource dependence perspective*, Maple Press.

Porter, M., 1985. *Competitive advantage*. New York: Free Press.

Singer, J. D. 1998. Using SAS PROC MIXED to fit multilevel models, hierarchical models, and individual growth models. *Journal of Educational and Behavioral Statistics*, 24: 323-355.

Scherer, F. M., 1984. *Innovation and growth: Schumpeterian perspectives*, Cambridge, MA: MIT Press

Tolbert, P. S., & Zucker, L. G. 1996. Institutionalization of institutional theory. In S. Clegg, C. Hardy, & W. Nord (Eds.) *Handbook of organization studies*: 175-190. London, Sage.

Vroom, V. 1964. *Work and motivation*. New York: Wiley.

Werner, S., & Tosi, H. L. 1995. Other people's money: The effect of ownership on compensation strategy and managerial pay. *Academy of Management Journal*, 38: 1672-1691.

Wiseman, R. M. Gomez-Mejia, L. R., & Fugate, M. 2000. Rethinking compensation risk. In S. Rynes & B. Gerhart (Eds.) *Compensation in organizations*. San Francisco, CA: Jossey-Bass.

Woodward, J. 1965. *Industrial organization: Theory and practice*, London. Oxford University Press.

Wright, P. M., & McMahan, G. C. 1992. Theoretical perspectives for strategic human resource management. *Journal of Management*, 18: 295-320.

Zenger, T. R., & Marshall, C. R. 2000. Determinants of incentive intensity in group-based rewards. *Academy of Management Journal*, 43: 149-163.

Endnotes

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[i] We do not include industry-level predictor.
[ii] We use the following model.

$$(\text{Dependent variable})_{ijk} = \beta_{0jk} + \beta_{1jk}\ (\text{R\&D Job})_{ijk} + \beta_2\ (\text{Job level})_{ijk} + \beta_3\ (\text{Tenure})_{ijk} + \varepsilon_{ijk}$$

$$\beta_{0jk} = \gamma_{00jk} + \gamma_{01jk}(\text{Firm size})_{jk} + \gamma_{02jk}(\text{Firm performance})_{jk} + \gamma_{03jk}(\text{Closing price})_{jk} + \gamma_{04jk}(\text{Cash flow})_{jk} + \gamma_{05jk}(\text{Innovation})_{jk} + U_{0jk}$$

$$\gamma_{00jk} = \tau + V_{00k}$$