Incentive Effects of Promotions on Employee Participation: The Case of Korean Auto Workers

Daechang Lee
Kia Economic Research Institute
78, Samsung-dong, Kangnam-gu, Seoul, 135-090, Korea
tel: 822-516-6288
fax: 822-544-9203

prepared for
The International Motor Vehicle Program
Research Briefing Meeting, Toronto
June 1995

Incentive Effects of Promotions on Employee Participation: The Case of Korean Auto Workers

In many auto plants, only a limited number of first-line supervisory positions are available to promotion candidates from production workers. And mostly evaluation of workers is based on their work performances, both on and off the production line. This paper is to investigate how well the promotion system of auto workers can elicit from them incentive effects on their off-line performances, such as suggestions and QC circle activities, using data from some Korean auto plants.

In the tournament games only the winner can advance to the next rounds of competition. The important feature of tournament is that the reward is based on the rank order among competitors rather than absolute level of their performances. This type of reward system can be widely found in competition for promotion in business organizations. For example, many hourly workers in manufacturing plants compete for a limited number of supervisory positions; a number of vice presidents in a firm strive for one coveted position of president.

The employee participation in improvement activities have been thought of as one of the best practices taken in many auto plants around the world. So we can find auto firms often evaluating their workers on the basis of how good performances they show in off-line activities such as suggestions and QC circles. Or at least it is one of many evaluating items. Since the opportunity of promotions is limited but often known to production workers in advance, it may be regarded as prizes open to candidates.

Tournament theory shows that compensation based on relative order can give participants an incentive to provide an optimal level of efforts under certain a set of assumptions. It is often argued that the optimal level of efforts depend positively on the price differential for winning the game. There has been many studies to analyze the benefits and costs that employee participation activities can give individual workers [Cooke (1990)]. However, few attempts have been made to test if promotion tournaments can induce workers to involve more actively in employee participation. In this study I seek to test the incentive effects of promotion using data from a survey of Korean auto plants.

<Table 1> Off-line Improvement Activities of Would Auto Industries.

	Korea	Japan	U.S.	Europe	NIEs
number of suggestions per employee(annual)	85	210	0.4	0.8	65
adoption rate(%)	44	80	27	30	44
workers in QC circles(%)	98	94	35	37	71

Source: MacDuffie and Pil, The International Assembly Plant Study, IMVP Research Briefing Meeting, Berlin, 1994

1. Suggestions and QC Circle Activities in Korean Auto Plants

It was early 1970s that production workers with Korean auto makers began to conduct suggestions and QC circle activities. Kia Motors started its QC circle activities in 1972 and suggestion system in 1973. Hyundai Motors also implemented its suggestion system from 1975 and introduced the management codes of QC circles in 1976. Korean makers were in a cooperative relationship with Japanese auto makers so that they could learn suggestions and QC circle activities from Japanese auto makers. Details of the suggestion system from suggestion procedure to organization structure to award system were almost the same as those of Japanese makers such as Toyota [Moden (1993)].

It was a time when Korean makers could build for the first time their own comprehensive auto plants including engine manufacturing facilities. As the size of Korean domestic car market was getting bigger and the car export rose from mid-1980s, these two types of employee participation got more activated in each Korean auto maker. Therefore in most of Korean auto makers these type of employee participation have been implemented for more than 20 years. But some makers recently quit QC circle activities and introduced new type of group activities instead. QC circle itself is part of formal organization of the work place in all Korean auto makers. So QC circle leader is in charge of regular work on the line as well as QC circle activities. Individual worker defines and examines the problem and then generates ideas to solve it. He then summarizes his ideas on a suggestion form and submit it to his supervisor. The supervisor should review on the shop floor the contents of suggestions from his subordinate workmen.

The contents of suggestion and QC circle activities can be classified into 6 categories: quality, work method, tool handling, machinery and equipment, so-called 5S, and management method. Every month the evaluation starts at the department that the individual workers or QC circles belong to. Whether or not a suggestion will be adopted is determined at the department level.

For example, at Kia Motors, a suggestion is supposed to be given one of ten grades depending on its score. The suggestion committee at each level assesses suggestions recommended from its subordinate committees. So once adopted, suggestions proceed to higher level suggestion committee and earn better grades. The amount of award money usually depend on the grade earned. Beside award money, some auto makers give additional fringe benefits to those workers showing high performance in improvement activities. Moreover the record on individual workers' suggestion and QC circle activities is reflected in the personnel evaluation conducted periodically.

<Table 2> Off-line Improvement Activities in Some Korean Auto Plants

	'85	'86	'87	'88	'89	'90	'91	'92	'93
Number of suggestions per employee(annual)	10	13	21	94	38	20	14	23	26
Number of activities per circle(annual)	3.1	2.9	3.1	3.7	2.6	1.7	2.0	2.1	1.8

Source: M and N auto plants, "Improvement Activities Report", 1994

2. Personnel System for Production Workers in Korean Auto Industry

(1) Organization and Job Positions

The formal organization of Korean auto plants looks like a pyramid. The plant consists of several divisions called "Boo," which are headed by general managers named "Boojang." Each division has also several departments called "Gwa" led by a production manager named "Gwajang."

The production manager are supported by assistant manager and chief supervisor. The production managers in Korean auto plants are selected from white color workers. Production workers can promote to chief supervisor. In each department there are about 4 sections or 80 workmen whose heads are supervisors named 'Banjang' or 'Jigjang'. One section usually consists of 2 or 3 teams or about 20 workmen and each team have 7 to 12 workmen.

<Table 3> Job Positions and Composition of Production Workers

Job Level	Job Position	Company A	Company B
3rd level	Chief Supervisor	(9) 0.7%	(5) 0.6%
4th level A	Supervisor	(7) 4.5%	(5) 2.4%
4th level B			(2) 3.0%
Non-job level	Team leader	(3) 9.3%	(3) 9.5%
	Worker	(3) 85.6%	(3) 84.6%

Source: A and B Motors' Manpower Management Departments
Note: number in parenthesis is minimum required years for job promotion.

(2) Promotions and Evaluation System

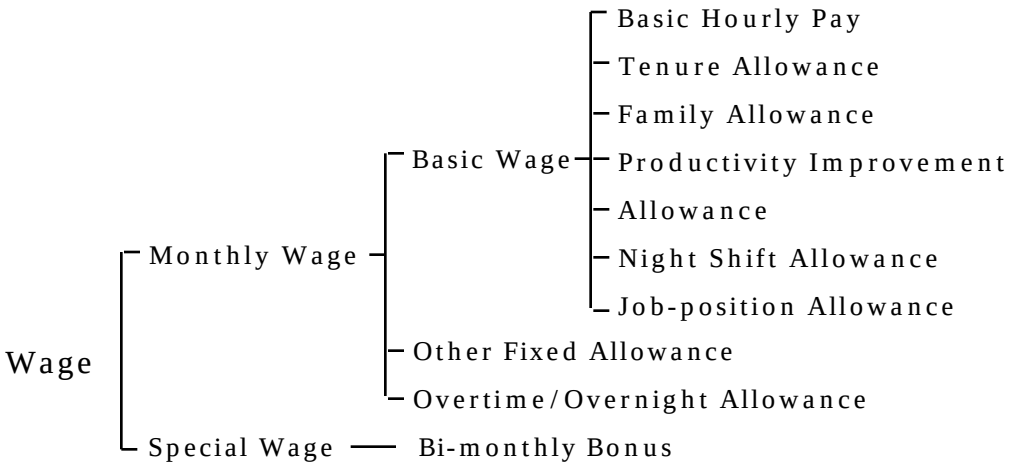
Promotions to team leaders and supervisors are possible only when there are some vacancies in those positions. So opportunities of job promotions are available to workers either when current team leaders or supervisors are about to leave the company for any reasons or when new positions are created because of organizational expansion. As an exception, in some companies, job promotion to a position higher than supervisor is not limited by the organization structure. However, even in the case, the organization table is surely considered as a basis upon which management adjusts the number of supervisory positions.

Such structure of organization indicates that the opportunities of job promotion in Korean auto plants is quite restricted and that the competition among candidates becomes very fierce. Promotions to supervisory positions requires some qualifications including minimum years of employment in lower position.

Evaluation items includes periodic personnel evaluation, written test, report, seniority and education performance. Weight of a sum of personnel evaluation and written test ranges from 70 to 95% in Korean auto companies. Personnel evaluation of workers' performance and ability is conducted periodically by supervisors in next higher position. Of course, suggestion and QC circle contribution are reflected in this personnel evaluation.

(3) Pay System

<figure 1> Hyundai's Wage Structure for Production Workers



Source: Hyundai Motors and Hyundai Motors labor Union, 1994

When a production worker is hired, his pay grade is decided depending on his background: Job experience prior to entrance, skill certificate, and military experience. Every year his pay is upgraded as his seniority builds up or as he is promoted to higher job positions. The pay upgrade or pay promotion is allowed almost automatically to workers unless they committed serious misconduct. In the past there was a special upgrade system by which managers could discriminate their workers in evaluation according to attitudes and performances they had shown. This system was abolished in collective bargaining of the late 1980s by the request of labor unions.

Wage increase incurred by annual upgrade is usually much smaller than wage gain by wage negotiation conducted every year. The most remarkable feature of wage structure in Korean auto industry is that production workers' wage depends heavily on their personal characteristics like seniority rather than on those of jobs they hold. Only less than 7% of wage is related to jobs and job positions.

<Table 4> Decomposition of Wage: Korean Automakers

	Company		
	A	B	C
wage related to personal characteristics	93.8%	96.1%	93.5%
wage related to job or job or job position	6.2%	3.9%	6.5%

Source: Daewoo, Hyundai, Kia Motors

As explained above, it does seem that the personnel system of Korean auto makers provides production workers with little opportunity to promote to higher positions.

Also, its wage system weighs against jobs and job positions a worker holds. So one can expect that most of the workers feel little incentive to invest their efforts to show better performance while competing for good jobs or job positions. According to interviews with workers and managers, job promotions in Korean auto plants is almost automatically in seniority order. It is said that jobs preferred by workers are assigned to senior workers.

3. Tournament Theory

In tournament games only winners can advance to next rounds of competitions. The important feature of tournament game is that in this type of reward system matters their relative ordering among competitors rather than their absolute records or scores. The tournament theory has studied how participants would respond when this system is put into effect, how much effort they would make to win a race, or what would determine the optimal level of efforts. It also deals with how and why the prize structure of a tournament or players' characteristics can gain something to do with the level of efforts. [Lazear and Rosen (1991), Green and Stokey (1993), Nalebuff and Stiglitz (1983)]

We can find this tournament style reward system applying to various types of competition like promotions in the business organizations as well as in sport games. Salespersons are often paid a bonus according to their relative rank in a sales competition with other colleagues. Several vice-presidents also compete for one coveted position of president in a firm. And in an auction one who makes a bid for a good with a bit higher price would win.

Bull, Schotter, and Weigett(1987) illustrates using a simplified model of non-cooperative game that the efforts level chosen by agents in the tournaments will increase proportionally with the prize differential for winning while they will move inversely with both the cost of effort and variance of random shock to output. Many researchers also studied under what conditions tournament system might dominate other forms of incentive systems[Lazear and Rosen(1981) and Green and Stokey(1983)].

There have been few attempts made to test using corporate data whether tournaments can elicit expected effort response. Ehrenberg and Bognanno(1988, 1990) tested it using data from professional golf tournaments and showed that tournaments' prize structures affect players' performances.

4. Analytical Framework

My econometric work is based on implications derived from a simple model of two-contestants non-cooperative game as in Bull, Schotter, and Weigett(1987). As mentioned earlier, each production worker's involvement in employee participation such as suggestion and QC circle activities depend on his efforts, a pure random or luck component, and some specific factors such as work load, adversity of work environment, labor relation on the shop floor. We assume that for simplification the last two factors affect all workers in a promotion competition equally. Here an important assumption is that production workers select their effort levels in doing suggestion and QC circle activities. This may be not the case. One can argue that they always do their best in doing suggestion and QC circle activities. It is also emphasized that this type of improve activities should be done on a voluntary basis.

However, as shown in <Table 2>, workers' performance of suggestion and QC circle activities has not been consistent but been fluctuated over years. We also heard from managers that many times they had to urge workers to make efforts for suggestion and QC circle activities. Furthermore, to most of workers these improvement activities are not so easy.

They should invest their extra time in studying or make more efforts to achieve improvement. This means that all workers face some cost of efforts to involve actively in employee participation.

Given a prize structure and cost of efforts, each worker is assumed to choose his efforts level to maximize his expected gain(utility). Under mild conditions we can show there exists a solution of optimal effort level.

$E_{ij} = f_{ij}((w_1 - w_2), A_{jo}, A_{jc}, D_i) + e_{ij}$

Here E_{ij} is individual j's number of suggestions in a department i, $w_1 - w_2$ is the wage differential for promotion, A_{jo} and A_{jc} are measures of the player's own ability and his competitor's ability, D_i is the department-specific factors, and e_{ij} is a random shock.

5. Estimation

In deciding on whether to promote one employee, worker's performance of employee participation is reflected in evaluation with a fixed weight given to it in some auto makers while others don't set such a fixed weight and leave it to supervisors.

However, even if its share is fixed, the importance of suggestion and QC circle activities can be subject to change across departments or by supervisors.

The optimal efforts level will be determined by various factors which have something to do with cost. Those can be age, education, tenure, the extent of job rotations, and help from colleagues or supervisors. They can affect efforts level in two different ways. It is because it alters the absolute level of cost while it also changes relative rank among participants. The higher their cost of effort is, the less efforts will be exerted by workers. Also if they show large difference in their ability it is expected that they will make less efforts.

(1) Data

Data used in this study was obtained from survey of individual workers and documents provided by both departments of human resource management and of quality management at two Korean auto plants in 1993. First I could get two different sets of data on suggestions. One is from survey of individual workers. They are asked how many suggestions they made in 1992 and how many of them were actually adopted. From the department of quality management I could collect number of suggestions and QC circle activities which were added up by each department.

Survey on individual workers also include their answer to questions to ask their opinions about promotion, wage, work rules and working environment, shop floor labor relation, communication, training and so on. Another set of data collected from department of human resource management shows us who was promoted to a leader or supervisor in which team or which department. According to this source the supervisor is appointed to an organization among many candidates from the same organization without exception. This is also true to the case of team leader. That is, a new team leader is selected from team workers belonging to the same team. In the survey of individual workers were the questionnaire sent to a total of 4,000 workers, which were sampled proportionally by plant, grade, and department from the population and amounted to almost 30% of the population. Among them 2,960 were returned.

From the survey number of suggestions done annually by individual worker(SUG) and number of suggestions adopted(SUGA) were used as dependent variables in the regression analysis. These were what individual workers answered to questions like how many suggestions they made and how many among them were adopted. In the data from the department of quality management were included number of suggestions done in 1992 by each department, number of adopted ones, and number of QC circle activities in each department. The variables such as the rate of suggestion attainment (RSUG= # suggestions/# goal), the rate of adoption (RIMP= # adopted suggestions/# goal), and the rate of QC circle activities attainment(RQCA = # QC circle activities/# goal) were all derived from this source. Using the data from the department of human resource management we can also introduce the variables to illustrate whether there is a new leader appointed as of early April in 1993(CHO), ! a ratio of new leaders to all workers in the department(LEADER), a ratio of new supervisors to all workers in the department(SUPERV), and a ratio of new chief supervisors to all workers in the department(CHIEF).

There are many other variables derived from the survey. In the next the regression analysis will be done in two ways. The one is to study how individual workers' suggestion activities are related to promotion opportunities available to a team, using data on suggestions to individual workers and promotions such as SUG, SUGA, and CHO.

This other is to analyze how the group performances of conducting suggestions and QC circle activities in the department level are related to promotions opportunities available to a department, using mainly the data from the department of quality management like variables of LEADER, SUPERV, and CHIEF.

Among other variables collected from the survey are the indices measuring work environments, communication and work attitude, labor relations, and work system. Demographic variables are also available from the survey. Especially for analysis on a department basis we derive some department-specific variables from the survey of individual workers. They are the department average or stand deviation calculated using individual workers' responses only by those in non-job level. The prefix **M** in a variable indicates it is the department average and **S** a department standard deviation, respectively.

Communication and work attitude: To investigate the relation between communication and work attitude of production worker on the one hand and employee participation on the other hand. They include the degree to which production workers feel comfortable in communicating with their supervisors (UCOM, 1= very uncomfortable,.. 5= very comfortable) and the average level of UCOM in a department (MUC), the extent of workers' commitment to the company (COMMIT, 1=very low commitment,.. 5=very high commitment) and its average (MCOMMIT) and standard deviation (SCOMMIT) in a department.

Workers' preference between higher wage and higher job position is reflected in PVSW (1=higher wage is much more preferred,... 5=higher position is much more preferred.)

Work system: It indicates in part how work is organized and how much different job experience workers have had. For example, the extent of job rotation across teams is reflected in MROTATE(1= very infrequent,.. 5=very frequent). MULTI shows how many different tasks a worker have carried out since he enter the company.

Work environment: This index measures the extent of danger to which workers are exposed (MDANGER), the degree of tedium or boredom which workers feel while carrying out their jobs (MTED), workload(MHEAVY).

Labor relation on the shop floor: This includes indices measuring the relation with team leader (LREL, 1=very hostile,.. 5=very friendly), the relation with supervisor (SREL). The degree of managerial leadership supervisors can exert on the shopfloor (SAUTHO, 1=very limited,.. 5=very extensive).

(2) Estimation Outcomes

<Table 5> Descriptive Statistics: Survey of Individual Workers (N=550)

Variable	Content	Mean	Std Dev
PLANT	0=M plant, 1=N plant	0.50727	0.5004022
PART	1=line work, 2=otherwise	1.18181	0.3860457
PVSW	promotion preference	2.27372	1.0975639
ROT	job rotation(1-5)	2.06077	1.0119165
MULTI	multi-task experience	4.85454	4.6686888
UCOM	upward communication	3.30418	0.8545716
COMMIT	workers' commitment	3.83180	0.8796920
LREL	relation with leader	3.56410	0.6776327
SREL	relation with supervisor	3.38686	0.7205338
SUG	annual # of suggestions	48.42909	57.4737563
SUGA	adopted suggestions	21.00545	39.0720922
MARRIED	1 if married, 0 if not	0.59636	0.4910728
EDUC	years of schooling	11.92727	0.6843168
TENURE	years of employment	4.83196	2.9671958
MUC	depts' average of UCOM	3.29458	0.2897003
MCOMMIT	depts' average of COMMIT	3.78704	0.2087347
MSR	depts' average of SREL	3.57899	0.1552419
MTED	extent of tedium/boredom	2.98082	0.4003617
MDANGER	danger at worksite	1.85126	0.4088435
MHV	degree of workload	3.20836	0.2926097
MRT	extent of job rotation	2.04436	0.3690756
SPW	std. dev. of PVSW	1.11603	0.1852928
MRT	extent of job rotation	2.04436	0.3690756
SPW	std. dev. of PVSW	1.11603	0.1852928
SMULTI	std. dev. of MULTI	3.8556113	2.3674003
SAG	std. dev. of AGE	3.0132946	1.5921344
SED	std. dev. of EDUC	0.4482650	0.5356879
LEADER	# new leaders in a team	0.3636364	0.6924952
SUPERV	new supervisors/workers	0.0032734	0.0044317
CHIEF	new chiefs/workers	0.0001916	0.0005721

As we can see in Table 6, the analysis shows that workers' participation in suggestion activities is positively related with their preference for promotion while being negatively related with their workload and the extent of job rotation.

<Table 6> Regression Analysis of Individual Workers' Suggestions

Dependent Variable: SUG(# suggestions)		
Variables	Estimate	t-value
Intercept	-214.563366	-2.723*
MCOMMIT	48.662802	3.744**
MRT	-52.857968	-5.265**
MSR	34.815686	1.888
MHV	-25.222538	-2.620*
SPW	45.558320	3.359**
SMULTI	-2.491657	-2.026
PVSW	4.701314	2.184
PART	-19.722162	-2.017
MLR	47.034343	2.129
TENURE	-1.726219	-2.081
MTED	-12.850982	-1.200
R^2	0.1188	

* Statistically significant at the .05 level; ** at the 0.01 level.

Moreover if statistically insignificant, the suggestion activities is likely to decline as workers stay longer in the company, which may imply they give up a promotion to supervisory positions after a certain period of time. The promotion opportunities are not likely to have any signification relation with intensity of suggestion activities. So we may interpret this as that the promotion policies in this auto plants do not motivate workers to devote themselves to employee participation like suggestion.

<Table 7> Regression Analysis of Adopted Suggestions

Dependent Variable: SUGA(# of adopted suggestions)		
Variables	Estimate	t-value
Intercept	24.947761	0.663
LEADER	6.309733	2.598*
TENURE	-1.004035	-1.772
MHV	-14.553006	-2.421*
MDANGER	-8.440612	-1.951
MCOMMIT	14.636193	1.833
PVSW	2.450813	1.611
R^2	0.0377	

On the other hand, the number of adopted suggestions showed a significant correlation with promotion opportunities. Workers belonging to a circle where a new leader was promoted have 6 more adopted suggestions than those from other circles do. So one can argue that competition for promotion does elicit more effective suggestion efforts from workers.

Next the suggestion and QC circle activities will be analyzed on a department basis. For this purpose we derive some department- specific variables from the survey of individual workers. They are the department average or stand deviation calculated using individual workers' responses. Data of 60 department were finally usable in the analysis. Among variables not explained in the above are RSUG(ratio of number of suggestions to goal), RADOPT (ratio of number of adopted suggestions to goal), and RQCA(QC circle activities/goal).

Two other important variables used in the regression analysis are MPROD and MQUAL. These are the department averages of workers' responses to questions like 'What do you think about productivity change over past 3 years?' and 'What do you think about quality change over past 3 years?'(The workers chose one of 5 given answers like 1= seriously deteriorated, 2= deteriorated,..., 5=remarkably improved.) YP means time elapsed after minimum years required for promotion to leader.

In this regression analysis, what we used as information on suggestions and QC circle activities is data from the department of quality management rather than those from workers survey. The contestants will get more motivated if more promotion opportunities are available because their expected value of promotion rises. To test this we will regress promotion opportunities and other explanatory variables on suggestion attainment, the suggestion adoption rate, and QC circle activities attainment. These three dependent variables were expressed in a logistic form(LRSUG, LRADOPT and LRQCA). What we pay attention to is whether there is a significantly positive relation between these dependent variables and degree of promotion opportunities.

Furthermore it will be of great interest to see whether suggestions, adoption rate and QC circle activities have strong correlation with promotion.

The relationship between extent of job rotation and employee participation is also of great interest. We adopted the method of stepwise regression when choosing explanatory variables in the regressions. As we can find out from <Table 9> there is no strong correlation between suggestion

attainment and promotions. As it was when using individual workers' data, the adoption rate shows statistically significant correlation with promotions only in some plants.

<Table 8> Descriptive Statistics on Department Basis (n=60)

Variable	content	Min	Max	Mean	S.D
RSUG	suggestions attainment	0	4.83	0.80	0.816
RADOPT	adoption rate	0	1.58	0.29	0.306
RQCA	QC activity attainment	0	4.06	0.53	0.598
MAGE	average age	23.80	41.16	30.05	2.959
SAGE	s.d. of age	0.80	9.34	3.26	1.961
MEDUC	average yrs schooling	9.50	14.13	11.95	0.503
MMAR	ratio of married workers	0	1.00	0.59	0.224
MCOM	average COMMIT	2.80	4.50	3.79	0.307
SCOMMIT	s.d. of COMMIT	0.35	1.37	0.81	0.253
MSREL	average of SREL	2.78	4.50	3.40	0.267
MLREL	average of LREL	2.89	4.75	3.61	0.246
MSAUTHO	average of SAUTHO	1.80	3.77	2.81	0.361
MWAGE	wage satisfaction	1.60	2.57	2.00	0.210
MYP	average of YP	-1.57	13.00	2.44	2.594
MTED	extent of tedium/boredom	1.60	3.80	2.74	0.525
MDANGER	degree of danger	1.00	3.60	2.01	0.583
MHV	degree of workload	2.40	4.08	3.16	0.356
MROTATE	extent of job rotation	1.33	3.57	2.28	0.506
MSUG	# of suggestions	4.00	178.33	41.33	28.016
MADOPT	# of adopted suggestions	2.00	59.75	19.20	12.667
MPROD	productivity improvement	3.10	4.50	3.93	0.315
MQUAL	quality improvement	2.40	3.66	2.99	0.280
MPFAIR	fairness in promotion	1.56	3.40	2.39	0.406
MEFAIR	fairness in evaluation	1.83	3.60	2.76	0.350
LCONTEST	# contestants	0	1.00	0.70	0.262
CHIEF	new chief in a department	0	0.002	0.00007	0.00038
SUPERV	new supervisors in a dept	0	0.025	0.004	0.005
LEADER	new team leaders in a dept	0	0.259	0.04	0.059
MPL	dummy(0 if M plant)	0	1.00	0.43	0.484

Source: Kia Economic Research Institute, "Survey on Personnel System for Auto Production Workers in Korea," 1993

<Table 9> Regression Analysis: Suggestion Attainment

Dependent Variable: LRSUG(Rate of suggestion attainment)					
All		M Plant		N Plant	
Intercept	-7.595150	Intercept	0.68755	Intercept	221.234
	(-0.083)		(3.242)**		(2.010)
MCOMMIT	23.71369	MROTATE	-0.19944	MWAGE	-109.9434
	(1.463)		(-2.122)*		(-1.925)
MWAGE	-39.313532				
	(-1.517)				
R^2	0.1022	R^2	0.1305	R^2	0.1247

* numbers in parentheses are t-values

More opportunities of promotions to supervisor shows strong positive correlation with adoption rate in M plant as we can see in <Table 10>. Promotions to leaders are also positively related to adoption rate. That the adoption rate is higher as MYP is larger may be explained as seniority effect. That is, the department with more senior workers is likely to show higher adoption rate. On the other hand, QC circle activities in M plant are likely to decline as there are more workers with long seniority.

<Table 10> The Adoption Rate

Dependent Variable: LRADOPT (the adoption rate)					
All		M Plant		N Plant	
Constant	6.920360	Constant	-2.33707	Constant	8.678202
	(1.035)		(-1.476)		(0.617)
MYP	0.722341	MEDUC	0.21626	MCOMMIT	-7.225635
	(2.759)**		(1.629)		(-2.177)*
MSAUTHO	-2.088351	LEADER	4.05701	MYP	2.035199
	(-1.535)		(1.793)		(2.573)*
MPFAIR	2.995481	SUPERV	58.76518	MPFAIR	6.633835
	(2.065)*		(2.559)*		(1.973)
MCOMMIT	-2.613728				
	(-1.543)				
R^2	0.1776	R^2	0.3750	R^2	0.3371

To our surprise, the extent of job rotation show negative correlation with suggestions in M plant and with QC circle activities in N plant, respectively. It may be possible because job rotations are conducted mainly for sharing hard or tedious works among workers rather than for developing workers skill level in Korean auto plants. This point was partially confirmed in the interviewed with workers and supervisors and in other study [LEE(1994)].

The fairness in promotion decision process has a positive relationship with the adoption rate, as expected. The averages years of schooling also shows positive correlation with QC circle activities. The older the workers in a department are, the higher the adoption rate is. The higher adoption rate is correlated with small age dispersion in a department. It may be because the competition gets more severe if workers are around the same age.

As the extent of commitment to the company is quite different among workers, a department is likely to have more QC circle activities. It may reflect the fact that SCOMMIT is positively correlated with MCOMMIT and higher SCOMMIT makes a decision process quicker in QC circles.

<Table 11> QC Circle Activities

Dependent Variable: LRQCA(QC circle activity attainment)					
All		M Plant		N Plant	
Constant	-247.382	Constant	-512.17366	Constant	1.596906
	(-4.157)**		(-4.766)**		(2.108)*
SCOMMIT	19.768	SCOMMIT	36.86095	MROTATE	-0.138312
	(2.894)**		(3.867)**		(-2.360)*
MEDUC	12.0342	MEDUC	27.94258	MEDUC	-0.094582
	(3.487)**		(4.828)**		(-1.559)
MAGE	3.019313	MAGE	7.33411		
	(3.488)**		(3.675)**		
SAGE	-2.692738	LEADER	119.84679		
	(-2.119)*		(1.772)		
MENV	-5.1386	MYP	-5.16375		
	(-1.887)		(-2.211)*		
MPFAIR	7.1758	MWAGE	-32.54636		
	(1.465)		(-2.191)*		
R^2	0.3546	R^2	0.6320	R^2	0.2282

However, the correlation between productivity and improvement activities shows some inconsistency. In M plant a department with a higher suggestion attainment rate was likely to achieve a considerable productivity increase over the past 3 years, but the adoption rate shows negative relation with it.

In N plant there was a large productivity improvement as QC circle activity attainment was high while the effect of high adoption rate is opposite to our expectation. So it is very hard to evaluate the effect of suggestion and QC circle activities on productivity with this outcome. The opportunity of promotion does not show any significant relation with productivity improvement.

<Table 12> Productivity Improvement

Dependent Variable: MPROD (Productivity Improvement)					
All		M Plant		N Plant	
Constant	2.8736	Constant	1.974151	Constant	-2.035190
	(3.302)**		(5.942)**		(-2.240)*
MEDUC	-0.121225	MHEAVY	0.174623	MWAGE	1.047349
	(-1.833)		(1.963)		(4.815)**
MHEAVY	0.374542	RIMP	-1.289030	MCOMMIT	0.824822
	(3.772)**		(-5.912)**		(5.234)**
MWAGE	0.626731	RSUG	0.294023	MTED	0.191809
	(3.265)**		(4.463)**		(2.699)**
RSUG	0.082087	MSAUTH	0.498854	RQCA	0.527465
	(1.928)		(5.816)**		(3.588)**
		SUPERV	26.721519	RSUG	-0.129520
			(2.840)**		(-2.141)*
				MLREL	0.251239
					(1.849)
				LEADER	0.778362
					(1.630)
				MSAUTH	-0.343614
					(-3.091)**
R^2	0.3195	R^2	0.7667	R^2	0.7863

In <Table 13>, the regression outcomes show that quality improvement have positive relation with promotion in M plant and it is also positively correlated with QC circle activity in N plant as expected.

<Table 13> Quality Improvement

Dependent Variable: MQUAL (Quality Improvement)			
M Plant		N Plant	
Constant	7.036013	Constant	3.749105
	(7.913)**		(6.129)**
MMAR	0.452760	SCOMMIT	-0.336736
	(2.054)*		(-1.835)
SAGE	0.053065	MWAGE	0.371408
	(2.794)**		(1.965)
SCOMMIT	-0.515806	MHV	-0.173870
	(-4.125)**		(-1.552)
MWAGE	-0.335946	MSAUTH	0.216676
	(-1.876)		(2.311)*
MLREL	-1.488534	MPFAIR	-0.765205
	(-4.410)**		(-5.747)**
LEADER	2.514359	QRCA	0.282415
	(2.519)**		(3.187)**
LCONTEST	0.651101	MROTATE	0.297368
	(2.162)		(3.568)**
MSREL	0.382061		
	(1.807)		
SUPERV	-19.764253		
	(-2.016)		
R^2	0.7512	R^2	0.7105

5. Conclusion

Korean auto makers adopted basically a seniority-based principle in many areas of personnel management. So most of job promotions and wage upgrade is made automatically as workers accumulate their seniority without providing motivation for competition. They compete for supervisory positions but the opportunities are so limited. The incentive effects of promotion is found not to be prevailing in Korean auto plants. Only in some plants where the plant does not expand any more the effect of promotion competition among workers are partly confirmed.

In fast growing plant there seems to be no incentive effects of promotion. So current personnel system seems to fail in eliciting more efforts for suggestion, QC circle activities, productivity improvement, and quality improvement from workers.

Furthermore in Korea the job rotation within team and across teams is not carried out with a view to flexible human resource management so that it may not help workers raise their problem- solving ability. Korean auto makers have sought some reform in personnel management system these days. It should be noted that the reform must come up with some devices to provide workers with more incentives for efforts and to enable makers to introduce more flexible human resource management as well as to support education for workers.

References

1. Bull, C., A. Schottor, and K. Weigelt (1987), "Tournaments and Piece Rates: An Experimental Study", Journal of Political Economy, vol. 95, no. 1, Univ. of Chicago.

2. Cooke, W. N (1990), Labor-Management Cooperation: New Partnerships or Going in Circles?, W.E. Upjohn Institute for Employment Research, Kalamazoo, Michigan.

3. Drago, Robert (1988), "Quality Circle Survival: An Exploratory Analysis," Industrial Relations, Vol 27, No. 3, Univ. of California.

4. Eaton, Adrienne E. (1994), "Factors Contributing to the Survival of Employee Participation Programs in Unionized Settings," Industrial and Labor Relation Review, Vol. 47, No. 3, Cornell University.

5. Green, J. R., and N. Stokey (1983), "A Comparison of Tournaments and Contracts." Journal of Political Economy, vol. 91, Univ. of Chicago.

6. Hyundai Motors (1992), The History of Hyundai Motors, Hyundai Motors, Seoul, Korea.

7. Kochan, T., H. Katz, and R. McKersie (1986), The Transformation of American Industrial Relations, Basic Books, Inc.

8. Lazear, Edward P., and Sherwin Rosen (1981), "Rank-Order Tournaments as Optimum Labor Contracts," Journal of Political Economy, vol. 89, no. 5, Univ. of Chicago.

9. Lee, Byoung-Hoon (1994), Internal Labor Market and Labor Relations in the Korean and Japanese Automobile Industries: The Case of Hyundai and Toyota, MS Thesis, Cornell University.

10. Lee, Daechang and Kunsoo Suh (1993), New Personnel Management System for Production Workers at Kia Motors, Kia Economic Research Institute, Seoul, Korea

11. MacDuffie, John Paul (1995), "Human Resource Bundles and Manufacturing Performance: Organizational Logic and Flexible Production Systems in the World Auto Industry", Industrial and Labor Relation Review, Vol. 48, No. 2, Cornell University.

12. Moden, Yasuhiro(1993), Toyota Production System: An Integrated Approach to Just-In-Time, 2nd ed., Institute of Industrial Engineers, Norcross, Georgia, USA

13. Nalebuff, Barry J. and Josoph E. Stiglitz(1983), "Prizes and Incentives: Towards a General Theory of Compensation and Competition." Bell Journal of Economics, vol. 14 pp 21-43

14. Womack, J.P., D. Jones, and D. Roos (1991), The Machine That Changed The World, HarperPerennial.

Appendix: Regression of Individual Workers' Suggestions by Plant

<Table A-1> Descriptive Statistics: M Plant (n=271)

Variable	Mean	Std Dev
PART	1.1992620	0.4001845
PVSW	2.3025830	1.1598023
ROTATION	1.9518519	0.9608973
MULTI	5.3911439	4.7330746
COMMIT	3.7888889	0.9063319
LREL	3.5498155	0.6356026
SREL	3.3431734	0.6914421
SUG	47.8339483	47.8839464
SUGA	19.0738007	45.7021972
MARRIED	0.7232472	0.4482209
EDUC	11.8413284	0.8123517
TENURE	6.4274293	3.1881277
MUC	3.2312855	0.3125070
MDC	2.5523201	0.4006538
MAH	3.3515202	0.1902984
MJH	3.1220287	0.2472085
MCOMMIT	3.7362431	0.1683836
MSAUTHO	2.8606524	0.2533686
MSREL	3.3325748	0.1794522
MLREL	3.5606705	0.1252057
MTED	2.9774652	0.4365228
MDANGER	1.7380059	0.3818805
MHV	3.2657646	0.3180760
MROTATION	1.9750504	0.4262729
SPW	1.1800111	0.1971171
SM	3.7813199	1.9770385
SAG	3.9828536	1.5866633
SED	0.6567195	0.5329141
LEADER	0.2915129	0.4867522
CHIEF	0.000388901	0.000767241
SUPERV	0.0012700	0.0026147

<Table A-2> Regression of Annual Suggestions: M Plant

Dependent Variable: SUG(# of suggestions)		
Variables	Estimates	t-value
INTERCEP	-157.760892	-1.397
PART	-24.725346	-2.377*
TENURE	-2.182198	-2.500*
MHV	-28.540319	-2.596*
SPW	37.051031	2.323
MROTATION	-24.288640	-2.074
MLREL	108.512031	3.749**
LREL	-9.475008	-2.185
SEDUC	-13.168938	-1.908
SUPERV	2076.282709	1.826
R2	0.1720	

<Table A-3> Regression of Annual Adopted Suggestions: M plant

Dependent Variable: SUGA(# of adopted suggestions)		
Variables	Estimates	t-value
INTERCEP	96.102398	1.104
MLO	-45.870585	-2.669*
TENURE	-1.577224	-1.815
MCR	29.346313	1.259
R2	0.0365	

<Table A-4> Descriptive Statistics: M Plant (N=279)

Variables	Mean	Std Dev
PART	1.1648746	0.3717341
PVSW	2.2454874	1.0343850
ROTATION	2.1684982	1.0506460
MULTI	4.3333333	4.5534397
UCOM	3.3956835	0.8292374
COMMIT	3.8736462	0.8524849
LREL	3.5781818	0.7175310
SREL	3.4296029	0.7466768
SUG	49.0071685	65.5417376
SUGA	22.8817204	31.2899584
MARRIED	0.4731183	0.5001740
EDUC	12.0107527	0.5192958
TENURE	3.2822581	1.6197241
MUC	3.3560707	0.2513742
MDC	2.4874694	0.3723018
MAH	3.3979191	0.1885805
MJH	3.2534333	0.2497826
MCOMMIT	3.8363867	0.2314022
MSAUTHO	2.7965045	0.1944020
MSREL	3.4177102	0.1865848
MLREL	3.5967987	0.1781081
MTED	2.9840900	0.3625638
MENV	1.9612670	0.4047374
MHV	3.1526157	0.2539551
MROTATION	2.1116967	0.2886015
MPF	2.6152069	0.2101583
MEF	2.9482729	0.1897716
SPW	1.0538942	0.1489970
SM	3.9280321	2.6957745
SAG	2.0715366	0.8685781
SED	0.2457878	0.4553779
LEADER	0.4336918	0.8407844
SUPERV	0.0052194	0.0049429

<Table A-5> Regression of Annual Suggestion: N plant

Dependent Variable: SUG (# suggestions)		
Variables	Estimates	t-value
Constant	177.685750	1.449
MCOMMIT	59.131270	3.393**
MPFAIR	-93.756938	-3.975**
MHV	-68.564981	-3.782**
SAG	-26.710194	-4.122**
SED	52.453103	4.262**
MUC	45.703130	2.572*
PVSW	6.652161	1.868
LEADER	6.427381	1.436
UCOM	-6.811365	-1.406
R^2	0.1985	

<Table A-6> Regression of Adopted Suggestions: N Plant

Dependent Variable: SUGA (# adopted suggestions)		
Variables	Estimates	t-value
Constant	-136.703430	-3.303**
MCOMMIT	45.028520	5.378**
LEADER	7.093302	3.364**
MUC	20.707575	2.305*
PVSW	3.022097	1.794
MLREL	-25.559005	-1.771
COMMIT	-4.612720	-2.034
LREL	4.814555	1.841
R^2	0.1708	