

Justice, Satisfaction and Commitment at R&D Institutes

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Abstract

In the literature, it is pointed that distributive justice explains pay satisfaction and job satisfaction better than procedural justice, and procedural justice explains organizational commitment and researcher's evaluation about the supervisor better than distributive justice. We empirically tested if these findings are valid in R&D institutes with the data collected from Korean R&D professionals. It is found that the relations between the justices and the outcome variables are more complicated. The result of the analysis shows that distributive justice is also significantly related to organizational commitment, but not to job satisfaction, and procedural justice is also significantly related to pay satisfaction, and job satisfaction. Implications of the findings and possible influence of the R&D setting are discussed.

1. Introduction

When "the way things should happen, or the way things are supposed to be" [27] matters, the problem of justice or fairness appears. Distributive justice defined by previous studies reflects some fair proportion between what to give and what to receive [2, 3, 4, 8, 14, 20, 24, 29]. In contrast, procedural justice defined as "the perceived fairness of decision-making process" [31],

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or “the perceived fairness of the means used to determine the amount of compensation employee receives” [8] concerns if the decision-making procedure or instrument is fair.

Landy, Barnes-Farrell, and Cleveland (1980) found that employee evaluation was recognized fair if the evaluation procedure was perceived fair. Cropanzano and Folger (1989) reported that a person resents most when he perceives that unfair procedure hinders his receiving rewards for the excellent performance. Brockner, Konovsky, Cooper-Schneider (1994) reported that, when procedural justice was perceived to be low, individuals reacted more adversely to the extent that they perceived outcomes to be negative.

Kim and Mauborgne (1993) found that the procedural justice raises compliance of local units to the headquarters in multi-national corporation. Leventhal (1980) discusses six principles in practicing procedural justice. Greenberg (1986) identified five procedural factors and two distributive factors required for fair performance appraisal. He also performed a laboratory experiment to find that, when the reward level was high, the participants perceived the rewarding fair regardless of fairness of the procedure used in deciding the reward level, but that they perceived treatments unfair most keenly when the reward level was low and the procedure was unfair [11]. Sheppard and Lewicki (1987) report similar results based on their analysis of managers' answers. Cropanzano and Folger (1991) argue as follows.

Traditionally the organizational science literature has considered only one way of describing what it means to be fairly treated, namely, the notion of distributive justice. A second way of thinking about what it means to be treated fairly – namely the notion of procedural justice – focuses not on the result of compensation decisions or other administrative decision that involve allocations of scarce resources among employees, but instead focuses on the fairness of the manner in which the decision-making process is conducted. In other words, the focus shifts from ‘what’ was decided to ‘how’ the decision was made.

Greenberg (1990) says, “the ... model ..., its validity remains to be established. It should be noted, however, that interest in attempting to examine

the processes underlying procedural justice effects is still extremely new. Thus, any efforts in this direction may be considered worthwhile despite their preliminary status." He also points that "very few studies have examined procedural justice among organizational employees in their organization." Responding to Greenberg, we want to replicate the research by applying the concept of procedural justice relative to distributive justice to Korean researchers. The importance of studying researchers is expressed by Dailey and Kirk(1992) who indicated that managers must pay attention to employees' perceptions of distributive and procedural justices since these constructs play central role in relation to job dissatisfaction and intention to quit, and that this is particularly important in organizations with professional or technically-skilled employees who may have high job mobility. Thus, our effort adds another empirical study to the works of Alexander and Ruderman (1987), Konovsky, Folger, and Cropanzano(1987), Folger and Konovsky (1989), and McFarlin and Sweeney(1992).

2. Hypotheses

Previous studies suggest that distributive justice explains pay satisfaction and job satisfaction better than procedural justice while procedural justice explains organizational commitment and worker's evaluation about the supervisor better than distributive justice [8, 15, 22]. Thus hypotheses for our empirical work are as follows.

Hypothesis 1. Distributive justice explains a researcher's pay satisfaction better than procedural justice.

Hypothesis 2. Distributive justice explains a researcher's job satisfaction better than procedural justice.

Hypothesis 3. Procedural justice explains a researcher's organizational commitment better than distributive justice.

Hypothesis 4. Procedural justice explains a researcher's evaluation about his supervisor better than distributive justice.

3. Methods

Subjects and Questionnaires

To minimize common method variance, two types of questionnaires were developed. Type A questionnaire excludes questions about procedural justice, and type B questionnaire excludes questions about distributive justice. And a researcher received only one type.

We contacted 12 R&D institutes. We wanted to cover three major industries in Korea, that is, chemical / pharmaceutical, machinery / shipping, and electronics / telecommunications. We selected 5 R&D institutes in the chemical / pharmaceutical industry, 4 in the machinery / shipping, and 3 in the electronics / telecommunications randomly from the publicized R&D centers counting about 100. Seven hundred and seventy questionnaires of both types (equal numbers) were proportionately distributed to the researchers of the institutes. The number 770 is a third of the number of researchers working at those 12 institutes. Two hundred and eighty questionnaires (145 type A and 135 type B questionnaires) were returned.

The average age of the researchers is 31.8 (s.d.=4.9), and their average tenure is 66.1 months (s.d. =51.2). Ninety-seven percent of the respondents are men. All of them had earned bachelor's degree, and 71% of them master's or doctoral degree in addition.

Demographic Information. Respondents were asked to supply a variety of demographic data, but were instructed not to write their names on the form.

Pay satisfaction. The two agree-disagree format items suggested by McFarlin and Sweeney (1992) were used to measure pay satisfaction. Seven-point Likert scale was used with 1 representing "strongly disagree," and 7 "strongly agree." The meaning of the scale is similar in the following explanations.

Job Satisfaction. Single item, "In general, how satisfied would you say you are with your job?" was asked using the seven-point Likert scale.

Organizational Commitment. The organizational commitment of a researcher was assessed using the abridged nine-item form of Organizational Commitment Questionnaire developed by Mowday, Steers, and Porter

(1979). Seven-point Likert scale was used in the same way.

Researcher's Evaluation about Supervisor. To measure this variable, it was asked McFarlin and Sweeney's (1992) single reversed seven-point item: "Overall, I think my boss is a poor performer."

Distributive Justice. This variable was measured using 6 items based on the studies of Price and Mueller (1986) and McFarlin and Sweeney (1992). Price and Mueller's (1986) Distributive Justice Index (modified) was used. The respondents were asked to indicate the extent to which they felt they had been fairly rewarded considering their (1) responsibility and status, (2) education and training, (3) amount of experience, (4) amount of effort, (5) amount of performance, and (6) stress and strain. Seven-point Likert scale was used in the same way.

Procedural Justice. We developed ten items to measure procedural justice, using basically the same format as with distributive justice. Respondents were asked to indicate the extents to which the procedures employed to (1) evaluate performance, (2) communicate evaluation feedback, (3) determine pay increase, (4) determine promotion, and (5) select persons who receive training/education were fair, and to indicate the extents to which the procedures had (6) consistency, (7) bias suppression, (8) accuracy, (9) correctability, and (10) representativeness. The first five items are related to specific rewards or evaluation, and developed from the existing studies [9, 22, 14].

The other five items are related to the general rules and principles in measuring procedural justice, and adapted from Leventhal (1980). Seven-point Likert scale was used in the same way.

To test the reliability of the variables measured with multi-items, Cronbach's alphas were calculated. See the diagonal cells of Table 1. Cronbach's alpha of pay satisfaction is 0.90, that of organizational commitment is 0.78, that of distributive justice is 0.92, and that of procedural justice is 0.92, all showing a satisfactory level of reliability.

To examine the construct validity of the measuring instrument, factor analysis is applied. Items measuring distributive justice were factored into one factor having Eigenvalue of 4.28 and cumulative explanation of variance 0.71. Items measuring procedural justice were factored into one factor and Eigenvalue and cumulative explanations of variance are 5.23 and 0.59. Thus

they are all at the satisfactory level.

4. Analyses and Results

Table 1 shows Pearson correlation coefficients between variables when two types of questionnaires are pooled. As can be seen, two types of justice are related to all the variables with the exception of job satisfaction. Contrary to our understanding, distributive justice is not significantly related to job satisfaction. Noteworthy relationships with regard to this conflicting result are those significant negative correlation coefficients between distributive justice and age and tenure. Though those are not significant there are positive correlation coefficients between job satisfaction and age and tenure.

Table 1. Pearson Correlation Coefficients (n=280)

	Means	Standard													
		Deviations	1	2	3	4	5	6	7	8	9	10			
1. Pay Satisfaction	3.12	1.57	0.90 ¹												
2. Job Satisfaction	4.35	1.17	0.10												
3. Organizational Commitment	4.66	0.94	0.25 ^{***}	0.41 ^{***}	0.78										
4. Evaluation about Supervisor	4.24	1.60	-0.00	0.16 ^{**}	0.25 ^{***}										
5. Distributive Justice (n=145)	3.42	1.17	0.74 ^{***}	0.12	0.44 ^{***}	0.09	0.92								
6. Procedural Justice (n=135)	3.49	0.95	0.37 ^{***}	0.29 ^{***}	0.48 ^{***}	0.33 ^{***}	-	0.92							
7. Age	31.84	4.86	-0.17 ^{**}	0.11	-0.01	-0.08	-0.35 ^{***}	0.07							
8. Sex	0.97	0.17	-0.01	0.04	0.02	-0.08	-0.02	0.13	0.18 ^{**}						
9. Pay	135.71	41.57	0.12 [*]	0.04	0.09	-0.16 ^{**}	-0.01	-0.03	0.64 ^{***}	0.14 [*]					
10. Tenure	66.09	51.17	0.01	0.08	-0.04	-0.15 [*]	-0.24 ^{**}	0.04	0.70 ^{***}	0.14 [*]	0.58 ^{***}				
11. Job Type	0.11	0.03	0.04	0.07	0.15 ^{**}	-0.07	-0.07	0.14	0.59 ^{***}	0.06	0.55 ^{***}	0.56 ^{***}			

1 Cronbach's alpha reliability estimates are shown on the diagonal

* p<.05, ** p<.01, *** p<.001

4.1 Analysis of Type A Questionnaires

The number of type A questionnaires returned is 145. The result of applying multiple regression analysis to this data set is shown in Table 2. Staines, Pottick and Fudge (1986) and McFarlin and Sweeney (1992) discuss the need to control factors like age, sex, pay, tenure, and job type. Hence it is included in the regression model. Sex and job type are included as dummy variables. Sex is 1 if the researcher is a man and 0 if a woman. Job type is 1 if rank of the researcher is principal researcher (the highest rank), and 0 otherwise. Principal researchers assume much more administrative workload than lower level researchers.

First we regressed control variables, that is, age, sex, pay, tenure, and job type on each of the dependent variables, that is, pay satisfaction, job satisfaction, organizational commitment, and researcher's evaluation about his supervisor. Then, we did the same having distributive justice included as an independent variable.

Table 2. Multiple Regression Analyses with Distributive Justice (n=145)

Independent Variables	Dependent Variables			
	Pay Satisfaction	Job Satisfaction	Organizational Commitment	Evaluation about Supervisor
Age	-0.290	0.272 [†]	0.181	0.365*
Sex	0.059**	0.053	0.045	-0.110
Pay	0.242	-0.135	-0.024	-0.141
Tenure	0.100	0.017	-0.160	-0.250*
Job Type	0.058	0.018	0.216*	-0.117
Distributive Justice	0.670**	0.217*	0.482**	0.142
F-value	34.049**	1.508	8.339**	2.171*
R-Square	0.597	0.062	0.266	0.086
F ₀ -value ¹	122.541**	5.570*	36.744**	1.949

1 $F_0 = \{(SSE_R - SSE_F) / (df_R - df_F)\} / (SSE_F / df_F)$, where SSE_R =error sum of square of the model without distributive justice, SSE_F =error sum of square of the model with distributive justice, df_R =degree of freedom of the model without distributive justice, and df_F =degree of freedom of the model with distributive justice.

[†] $p < .1$, * $p < .05$, ** $p < .01$

Table 2 indicates that some control variables explain some dependent variables well: sex explains pay satisfaction well, job type explains organizational commitment well, and age and tenure explain evaluation about supervisor well. The result also shows that distributive justice explains well pay satisfaction and organizational commitment, but not so well researcher's evaluation about supervisor. F-values ($F = (SSER - SSEF) / (dfR - dfF) / (SSEF / dfF)$, where SSER=error sum of square of the model without distributive justice, SSEF=error sum of square of the model with distributive justice, dfR=degree of freedom of the model without distributive justice, and dfF=degree of freedom of the model with distributive justice) are significant, except for the dependent variable of researcher's evaluation about supervisor. F-values are all significant except for job satisfaction. With respect to job satisfaction, we cannot say that distributive justice explains job satisfaction well as F-value is not significant, which implies that the regression model itself is not valid. For the model to be valid, it seems that we need independent variables like work condition, task contents, relations with supervisors and peers, etc. in the equation. R-squares are 0.597, 0.062, 0.266, and 0.086 respectively.

In any equation, the multicollinearity was not found, and the Durbin-Watson test showed that the problem in connection with auto-correlation of the error term is negligible.

The analysis of variance test of $\beta_j = 0$ versus $\beta_j \neq 0$ is an example of a general test for a linear statistical model. We have used regression analysis for testing whether or not the parameter of distributive justice is zero. Thus the full and restricted models can be expressed as follows.

$$Y_i = \beta_0 + \beta_1 A + \beta_2 S + \beta_3 P + \beta_4 T + \beta_5 K + \beta_6 D + \varepsilon_i \quad (\text{Full model})$$

$$Y_i = \beta_0 + \beta_1 A + \beta_2 S + \beta_3 P + \beta_4 T + \beta_5 K + \varepsilon_i \quad (\text{Restricted model})$$

where Y_i denotes dependent variables (pay satisfaction, job satisfaction, organizational commitment, or evaluation about supervisor), A age, S sex, P pay level, T tenure (number of months working at the institute), K job type, and D distributive justice.

$\beta_6 = 0$ for all the dependent variables except evaluation about supervisor. But $\beta_6 = 0$ for job satisfaction is meaningless as the related full model itself is not valid as explained above.

4.2 Analysis of Type B Questionnaires

The number of type B questionnaires returned is 135. Basically the same analysis as above, replacing distributive justice with procedural justice, was made with this data set, and the result is shown in Table 3. The result shows that, among control variables, age and pay explain pay satisfaction well. All F-values are significant and R-squares are 0.223, 0.101, 0.258, and 0.162 respectively. The result also shows that procedural justice explains all the dependent variables well. The F_{ϕ} -values are all significant, and $\beta_6=0$, for procedural justice, for all the dependent variables.

Table 3. Multiple Regression Analyses with Procedural Justice (n=135)

Independent Variables	Dependent Variables			
	Pay Satisfaction	Job Satisfaction	Organizational Commitment	Evaluation about Supervisor
Age	-0.427**	0.099	-0.112	-0.031
Sex	-0.103	-0.065	-0.079	-0.077
Pay	0.194*	-0.050	0.143	-0.186 ^ψ
Tenure	0.304	0.013	-0.187 ^ψ	-0.023
Job Type	-0.009	-0.055	0.134	0.063
Procedural Justice	0.360**	0.305**	0.475**	0.337**
F-value	6.261**	2.444*	7.757**	4.204**
R-Square	0.223	0.101	0.258	0.162
F_{ϕ} -value ¹	26.341**	10.304**	41.569**	16.063**

1 $F_{\phi} = \{(SSE_R - SSE_P) / (df_R - df_P)\} / (SSE_P / df_P)$, where SSE_R =error sum of square of the model without procedural justice, SSE_P =error sum of square of the model with procedural justice, df_R =degree of freedom of the model without procedural justice, and df_P =degree of freedom of the model with procedural justice.

^ψ $p < .1$, * $p < .05$, ** $p < .01$

Hypothesis 1 seems to be supported as the correlation coefficient between distributive justice and pay satisfaction (0.74) is bigger than that between procedural justice and pay satisfaction (0.37) (see Table 1), and the R-square in Table 2 (0.60) is bigger than that in Table 3 (0.22). But these do not lead to a definite affirmation of the hypothesis, because distributive and procedural justices are analyzed with the separate data. Hence, we need

further analysis to conclude which one has better explanatory power. (And this is why we analyze the grouped data as explained below.) Even though the value of correlation coefficient for procedural justice is less than that for distributive justice, still the correlation coefficient of 0.37 is significant at 0.1% level. These significant values imply that the relation between procedural justice and pay satisfaction is not negligible. It seems that this strong relation has been neglected.

Hypothesis 2, distributive justice explains a researcher's job satisfaction better than procedural justice, is rejected. Distributive justice is not a significant parameter to explain researcher's job satisfaction (see Tables 1), while procedural justice is a significant parameter (see Tables 1 and 3). Thus we cannot say that distributive justice explains a researcher's job satisfaction 'better' than procedural justice anyhow.

In the case of hypothesis 3, similar discussion as for hypothesis 1 is possible (note, however, that the magnitudes of R-squares are reversed). We cannot say which one of distributive and procedural justice explain organizational commitment better, and need further analyses. Again, it is to be heeded that the relation between distributive justice and organizational commitment is also strong, and it seems that this strong relation has been neglected.

Hypothesis 4 is supported. Only procedural justice is significantly related to researchers' evaluation about their supervisor (see Table 1). Table 2 and 3 show that distributive justice is not a significant parameter to explain researchers' evaluation about the supervisor, while procedural justice is a significant parameter.

Hypothesis 2 is rejected, and Hypothesis 4 is accepted. For Hypotheses 1 and 3, we need further analysis.

4.3 Analysis of the 70 Groups

If we can identify two similar researchers of whom one answered type A questionnaire and the other type B, then we can treat the two persons as an individual who answered both types A and B questionnaires without the common method variance. Following this line of reasoning, we could form maximally 70 groups. A group consists of more than one researcher who be-

long to the same laboratory, are of the same rank (that is, junior researcher, researcher, senior researcher, or principal researcher) and answered both types of questionnaires. If there are more than one researcher answering the same type of questionnaires, the average values are taken. We want to analyze the 70 groups thus formed in order to test the hypotheses.

We need to analyze the between and within group variances to see if between group variance is larger than within group variance as expected. It is confirmed that the between group variance is larger than the within group variance (F values were ranged from 1.23 to 3.87).

Then, Intra-Class Correlation (ICC) is analyzed. ICC(1), not ICC(2), is calculated as we want to estimate whether individuals within group "agree" in their responses. [13, 18, 28]. ICC(1) have ranged from 0 to 0.5, with a median of 0.12 [13]. When within group variance is larger than between group variance, however, we get negative ICC's. The positive ICC's of Table 4 (the rightmost column) show that the intra-group reliability is acceptable. Hence, the grouping is deemed appropriate for the variables.

Table 4. Pearson Correlation Coefficients (n=70)

	Standard		1	2	3	4	5	6	7	8	9	10	ICC(1) ¹
	Means	Deviations											
1. Pay Satisfaction	3.06	1.27	0.96 ¹										0.45
2. Job Satisfaction	4.52	0.96	0.05										0.07
3. Organizational Commitment	4.67	0.60	0.46 ^{***}	0.35 ^{**}	0.80								0.10
4. Evaluation about Supervisor	4.30	1.17	-0.00	0.21	0.39 ^{***}								0.14
5. Distributive Justice	3.41	1.10	0.63 ^{***}	0.19	0.47 ^{***}	0.11	0.93						0.35
6. Procedural Justice	3.46	0.86	0.35 ^{**}	0.28 [*]	0.42 ^{***}	0.13	0.28 [*]	0.93					0.33
7. Age	32.00	4.40	-0.26 [*]	0.02	-0.19	0.12	-0.38 ^{**}	0.06					
8. Sex	0.98	0.08	0.12	0.18	0.18	0.21	0.13	-0.13	-0.18				
9. Pay	132.88	34.74	0.09	-0.09	-0.10	-0.18	-0.06	-0.06	0.75 ^{***}	0.12			
10. Tenure	63.74	42.87	0.02	0.00	-0.21	-0.29 [*]	-0.25 [*]	0.02	0.80 ^{***}	0.14	0.73 ^{***}		
11. Job Type	0.11	0.03	0.06	0.04	0.18	-0.16	0.00	0.19	0.67 ^{***}	0.12	0.68 ^{***}	0.64 ^{***}	

1 Cronbach's alpha reliability estimates are shown on the diagonal.

2 $ICC(1) = (BMS - WMS) / (BMS + (k - 1)WMS)$, where BMS=between group mean square, WMS=within group mean square, and k=number of raters.

* p<.05, ** p<.01, *** p<.001

Table 4 shows the Pearson correlation coefficients of the grouped data. The correlation between distributive and procedural justice is only 0.28 even though it is significant at 5% level. Table 4 gives basically the same result as Table 1.

Table 4 includes the result of reliability and validity check with the grouped data. Cronbach's alphas for pay satisfaction, organizational commitment, distributive justice, and procedural justice are 0.96, 0.80, 0.93, and 0.93 respectively, while they were 0.90, 0.78, 0.92, and 0.92 with the non-grouped data, exhibiting satisfactory reliability levels. Factor analysis resulted in one factors of distributive justice, and of procedural justice, as the case with the non-grouped data. Thus, it seems that there is no statistical problem in using the grouped data.

Table 5 shows the result of hierarchical regression analysis for pay satisfaction (the dependent variable) with the grouped data. The second, third, fourth and last columns represent the equations

$$Y = -0.985A + 0.186S + 0.568P + 0.379T + 0.054K \text{ (Equation 1)}$$

$$Y = -0.619A + 0.104S + 0.312P + 0.442T - 0.035K + 0.503D \text{ (Equation 2)}$$

$$Y = -1.047A + 0.250S + 0.708P + 0.361T - 0.028K + 0.423R \text{ (Equation 3)}$$

$$Y = -0.767A + 0.172S + 0.482P + 0.411T - 0.067K + 0.359D \\ + 0.292R \text{ (Equation 4)}$$

respectively where Y denotes pay satisfaction, A age, S sex, P pay level, T tenure (number of months working at the institute), K job type, D distributive justice, and R procedural justice. What the values of each column signify in Table 6 is the same as above. Table 6 is for the dependent variable organizational commitment. Table 5 shows that age, sex, pay, and tenure explain pay satisfaction well in the full model. However, in Table 6, we find no significant control variable which explains organizational commitment satisfactorily in the full model. Tables 5 and 6 represent general increasing trends of F-values and R-squares as variables are added hierarchically.

Two methods were used to test the hypotheses. The first method is to see if the size of the change (the magnitude of ΔR -Square) in the third column (Equation 2) is larger or smaller than that in the fourth column (Equation 3) as expressed in the hypotheses. The second method is to see if, in the last column (Equation 4), the beta coefficient of distributive justice is larger or

smaller than that of procedural justice as is predicted in the hypotheses. See Tables 5 and 6.

Table 5. Hierarchical Regression Analysis of Pay Satisfaction (n=70)

Independent Variables	Beta Coefficients of Inserted Variables			
	Control Variables	Distributive Justice	Procedural Justice	All Variables
Age	-0.985**	-0.619**	-1.047**	-0.767**
Sex	0.186 [†]	0.104	0.250**	0.172*
Pay	0.568**	0.312*	0.708**	0.482**
Tenure	0.379*	0.422**	0.361*	0.411**
Job Type	0.054	-0.035	-0.028	-0.067
Distributive Justice		0.503**		0.359**
Procedural Justice			0.423**	0.292**
F-value	7.378**	12.338**	11.955**	13.577**
R-Square	0.362	0.536	0.529	0.601
ΔR-Square	0.362	0.174**	0.166**	0.239**

Ψ p<.1, * p<.05, ** p<.01

Table 6. Hierarchical Regression Analysis of Organizational Commitment (n=70)

Independent Variables	Beta Coefficients of Inserted Variables			
	Control Variables	Distributive Justice	Procedural Justice	All Variables
Age	-0.137	0.189	-0.209	-0.003
Sex	0.155	0.082	0.228*	0.170
Pay	0.103	-0.126	0.264	0.097
Tenure	-0.314	-0.257	-0.336 [†]	-0.298
Job Type	0.294*	0.214	0.200	0.173
Distributive Justice		0.446**		0.261**
Procedural Justice			0.470**	0.374**
F-value	2.078	4.017**	5.515**	5.493**
R-Square	0.140	0.277	0.344	0.383
ΔR-Square	0.140	0.137**	0.205**	0.243**

Ψ p<.1, * p<.05, ** p<.01

In Table 5, ΔR -Square for distributive justice is 0.174 (significant at $p < 0.01$). This means that distributive justice variable, when added, explains additional 17.4% of pay satisfaction, and the significance is at 1% level. This value is larger than that for procedural justice, 0.166. Hence, using the first method, it is shown that distributive justice explains pay satisfaction better than procedural justice. In the last column of Table 5, the beta coefficient for distributive justice is 0.359 (significant at $p < 0.01$), which is larger than that for procedural justice, 0.292. Hence, using the second method also, it is found that distributive justice explains pay satisfaction better than procedural justice. Thus we can say, as far as the related values are concerned, that Hypothesis 1 is supported. However, ΔR -Square for Equation 3 and the beta coefficient for procedural justice in Equation 4 are also significant. Procedural justice variable, when added replacing distributive justice variable, explains additional 16.6% of pay satisfaction, which is significant at 1% level (see the fourth column of Table 5). The beta coefficient for procedural justice is 0.292, which is also significant at 1% level (see the last column of Table 5). These mean that procedural justice explains pay satisfaction almost as well as distributive justice. Therefore, we need to acknowledge the importance of procedural justice in explaining pay satisfaction.

In Table 6, ΔR -Square for procedural justice is 0.205 (significant at $p < 0.01$), which is larger than that for distributive justice (0.137, significant at $p < 0.01$) (see the last row of Table 6). The beta coefficient for procedural justice is 0.374 (significant at $p < 0.01$), which is also larger than that for distributive justice (0.261, significant at $p < 0.01$) (see the last column of Table 6). Hence, it is found that procedural justice explains organizational commitment better than distributive justice. Thus, Hypothesis 3 is supported. However, the contribution of distributive justice is again significant. When procedural justice is added (Equation 3), R-Square increased by 20.5%, and when distributive justice is included (Equation 2) instead, R-Square increased by 13.7%, almost 7% less than that with procedural justice (see the last row of Table 6). The point is that this 13.7% increment is significant at 1% level. And the beta coefficient of distributive justice, 0.261, is also significant at 1% level (see the last column of Table 6). Thus distributive justice also explains organizational commitment as well as procedural justice.

5. Discussions

Finding of this study clearly shows that both distributive and procedural justices are closely related to pay satisfaction, and organizational commitment. Observe that procedural justice affects all the dependent variables, while distributive justice affects only pay satisfaction and organizational commitment. This result is quite different from the literature which says that pay satisfaction and job satisfaction are better explained by distributive justice while organizational commitment and employees' evaluation about the supervisor are better explained by procedural justice.

The implication of these results for R&D managers is that they should understand that procedural justice is more widely related to the important outcome variables, and that they should pay attention to researchers' perception of procedural justice beyond distributive justice because both the constructs play central roles in relation to the important outcome variables.

One may insist that there was some common method variance in our data, since it is self-reported. We do not deny that there may exist the variance. It should be noted, however, that respondents for distributive justice and those for procedural justice were strictly divided, so one of the most critical common method variance is removed. This separation of respondents may shed some light on future research, as the correlation coefficient between distributive and procedural justices used to be quite high, raising various problems (for example, the coefficient is 0.8 in Konovsky & Pugh, 1994). To overcome the incomparability problem caused by the separation, we formed the groups and analyzed them. This is apparently artificial, but we think this grouping provides another implication for future studies in justice. We find similar treatment in the organizational climate and leadership literature [12, 13, 17].

The third may argue that the R&D situation is the cause of the difference from the literature. It is difficult for us to agree with this opinion, as we are talking about satisfaction and commitment of a member of an organization, whose function may be R&D activities, or what not. We do not believe that professionals have so drastically estranged perceptions about one of the basic values of mankind. Even if the argument is right, we do not think that this is a weakness of this paper. We would rather counter that, if the R&D

setting is really the cause, we have found that professionals differ from others in the perceptions about justice.

The fourth may claim that the single-item scales for the two indices (job satisfaction and evaluation about supervisor) weaken the results. They may be right. But we want to refer Scarpello and Campbell (1983) who argue that single-item scales may not be as unreliable as previously thought. Indeed Witt and Nye's (1992) meta-analysis of job satisfaction shows that there was little difference of results between multiple-item and single-item scales. For all that, there still remains the validity concern.

The fifth may argue that there are sampling errors in this study. We do not deny that there may exist some sampling errors. However, we found in additional analysis that there had been no significant homogeneity problem between type A and B samples.

In conclusion, "what is distributed" (distributive justice) affects pay satisfaction and organizational commitment, and "how the decision is made" (procedural justice) affects all the outcome variables. Apparently the recent finding and study of procedural justice should be carefully recognized by the R&D managers.

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