

PERFORMANCE MEASUREMENT IN BUSINESS MANAGEMENT WITH INFORMATION TECHNOLOGIES

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Abstract. Widespread usage of the internet and computers have facilitated a number of human resource management activities such as compensation management, performance management, vocational training and other personnel management affairs across various enterprises. It is known that the employment of a qualified labour force becomes increasingly difficult due to increasing competition conditions. Therefore, it is important to ensure that the right person is recruited for the enterprise and that he/she is attached to his/her employer. Thanks to information technologies, the recruitment process can be implemented more quickly and effectively. The present study aims at determining whether the employer-employee has a sense of trust; whether employee's performance, disciplinary action, reporting status and significant inconvenience status are taken into account by an enterprise in the iron and steel industry. Logistic regression method is used as an analysis method. The effects of the demographic variables on the dependent variables are also determined. Considering the results obtained, it is observed that the loyalty of the employees to the employer is not very strong, but at the level of improvement, the employees do not consider working at the company for many years.

Keywords: *Employee performance, information technologies, logistic regression analysis.*

INTRODUCTION

The definition of performance can be a very difficult concept to come by because it includes innumerable factors and aspects (Akal, 2000). However, performance is generally defined as a point that can determine qualitative and quantitative reach of a worker's, group's or committee's aim (Bilgin, Taşçı, Kagnicioglu & Benligiray, 2004).

There are many criteria that can affect the performance of an employee in an enterprise. These criteria can change in every enterprise. It is expected that a performance criterion in an enterprise enhances the relationship between employees and their employers, as well as provide a basis for mutual trust. The main criteria of trust in studies conducted in the individual and organisational areas are determined as follows: job satisfaction, organisational citizenship behaviour, organisational commitment, labour turnover and performance, employee productivity, team performance, innovative behaviours, workplace behaviours, harmful behaviours, organisational income and profitability, etc. (Deluga, 1995; Dirks, 2001).

Although various methods are referenced in the literature in order to measure whether or not an event of trust can be achieved in an organisation, it cannot be determined with exact criteria due to its intuitive aspect. In addition, a strong sense of employee's trust to an organisation can improve the sustainability of the company. The following measures should be undertaken if performance management is to be sustained in a business (Ottley, 1999; Reid, 1995): (1) to identify the central core objectives as well as the stage of those objectives; (2) to identify the processes and activities for the strategies and plans adopted by the organisation and determine how these activities and performance are determined. According to Reid (1995), while determining these activities, elements such as necessity satisfaction, social equity, justice and equality, cultural diversity, support and respect and strengthening of the employee's trust should not be ignored. (3) to determine the awards to be given to employees in case performance targets are achieved (or the penalties to be taken in case of failing to achieve the objectives. (4) to identify Information flows (feedback and forward-looking cycles) that required to enable the organisation to learn from its experience.

The considerations above allow for better clarification of all the communication channels between the employees and the employer, as well as the processes needed for the measurement of their performance.

1. LITERATURE REVIEW

Some of the studies conducted to measure employee engagement, performance and motivation are:

"Business Industrial Relations Survey" by Klass determined the factors that were effective in dismissal of employees; 1596 workplaces were investigated in Australia. As a result of the study, it was determined that there were 12 variables affecting the dismissal (Klass, 1998).

Using a sequential logistic regression method, Ayhan determined the effects of work motivation, socio-demographic characteristics and job satisfaction on job-quitting intentions among nurses in the Turkish health system. As a result of the study, it was found that 10 explanatory variables had significant effects on the intention to quit the job (Ayhan, 2006).

Using significant and effective variables to assess the satisfaction levels of municipal services, a questionnaire was completed by 2110 individuals over the age of 18. The evaluation was made in terms of income and duration of stay in selected neighbourhoods of Eskişehir province. The results showed that the services carried out by the municipality and other general services of the municipalities had a negative impact on the inhabitants' satisfaction. However, the management services were found to have a more positive effect on the inhabitants' satisfaction (Cankuş, 2008).

Çolak conducted a survey of 628 small, medium and large-scale enterprises to measure their profitability levels and the relationship between their production inputs and outputs. The data were analysed using logistic regression and Utadis methods. The results of the study showed that the SMEs gave less importance to R&D and market research activities than large enterprises (Çolak, 2009).

Akarçesme aimed at determining the variables affecting the results of the teams in the Turkish Women Volleyball League competition and creating the models of competition results. In the study, competition statistics of the teams that entered the first eight in the 2008–2009 season were used. In this context, a binary logistic regression analysis was performed as the activity model and the technical activity model. As a result of the study, value for performance model was affected by the performance model, while the technical activity model was affected by the variables related to the error and score statistics (Akarçesme, 2010).

Çırak, in the spring semester of the 2011–2012 academic year, conducted a study on 4193 students studying at some faculties and undergraduate programmes of the University of Ankara. With the help of the data collected by the questionnaire, the students were classified according to their success. The aim of the study was to compare the total correct classification ratio by comparing logistic regression and artificial neural network models. As a result of the study, it was seen that artificial neural networks were better than logistic regression in the classification of the students according to their success (Çırak, 2012).

Ergin aimed at investigating the relationship between performance evaluation and motivation in municipal employees. A survey was conducted on 150 personnel working in 4 different district municipalities of Istanbul Metropolitan Municipality. The analysis was performed by using SPSS Statistical Software. As a result of the study, it was determined that the performance was significantly different from the demographic factors according to the educational status and the performance sub-dimension of performance-based performance appraisal. Motivation was found to differ from demographic factors to marital status, education level and sub-factors of motivation (Ergin, 2012).

Oktay compared logistic regression, logistic model and log-linear models in various respects statistically. In the research, the data of the Turkish Statistical Institute (TSI) Household Budget Survey 2009 were compared by logistic regression and log-linear models and then logistic and linear models. As a result of the study, it was determined that log-linear models or logistic regression should be chosen for the application, and the decision should be made according to the general purpose of the study and the measurement level of the variables (Oktay, 2012).

In order to determine employees' perception of healthcare systems, Top administered a total of 150 questionnaires completed by the private and state health sector professionals in Istanbul. The aim of the study was to investigate the perception of the employees about the effectiveness of information sharing and to analyse it by a logistic regression method. As a result of the study, it was concluded that in-house information sharing had a strategic advantage in the service sector and had to be effective in enterprises that were willing to be long-lasting (Top, 2012).

Bas used a logistic regression method to build a model for estimating future demand based on past order information of manufacturing businesses operating in Çukurova region. As a result of the study, it was seen that the logistic regression method was applicable to the supply chain elements and the model was formed by estimating the demand for the future (Bas, 2013).

Steinman et al. deployed a logistic regression method to analyse the data collected from the National Survey Occupational Rehabilitation Agency on the employment of disabled and visually impaired customers (Steinman et al., 2011). As a result of the study, it was concluded that 60.6 % of visually impaired customers were employed ve less than half of the visually impaired customers were recruited (Steinman, Kwan & Boeltzig-Brown, 2011).

Jacobsen and Andersen investigated the effects of performance management tools on innovation and performance in the state sector by using the logistic regression method. Between 2000 and 2005, 162 research units in Denmark established hypotheses on the variables of performance and innovation determined by each researcher. As a result of the study, it was found that performance management tools could have an effect on innovation and performance (Jacobsen & Anderson, 2014).

Gorecki and Krzysko made a new classification by combining various regression and classical methods and examined this classification on real data (Gorecki & Krzysko, 2014).

Using a logistic regression method, Han et al. (2014) also analysed the data from a survey of 2897 resident nurses in 5900 nursing homes. From the study, it could be concluded that the changes in their job satisfaction varied according to their tenure and daily working hours (Han, Trinkoff, Storr & Lerner, 2014).

While in the literature, employee engagement is often investigated in relation to performance and motivation, in the present study we research the relationship between employee engagement and report status, as well as disciplinary penalty and significant inconvenience status are also examined. In other studies, in the literature, the employee's commitment to the employer was generally evaluated only based on the motivation and performance of the employee. In this study, the relationship between the employee's commitment to motivation and performance as well as the status of employee's report and disciplinary punishment were examined. The present study aims at determining whether the employer-employee has a sense of trust; whether employee's performance, disciplinary action, reporting status and significant inconvenience status are taken into consideration by an enterprise in the iron and steel industry.

2. DATA

The survey was designed to measure the level of trust between the employer and the employee. In November 2014, the data were collected in an iron and steel company in Karabük province.

In the study, 60 employees were asked about their age, educational status, gender, marital status, residential neighbourhood, number of children, number of years worked for the company, medical report status, disciplinary action, performance (good, normal, bad) and significant inconvenience status. The number of employees in a shift is 80 and the participation rate is 75 %.

3. METHODOLOGY

In the study, the status of the employee's report, the condition of discomfort, disciplinary penalty status and performance of employees were investigated by a logistic regression method using IBM SPSS package program.

Logistic Regression

Logistic regression is a method used to determine the cause-effect relationship with independent variables in cases where the dependent variable is observed categorically, in binary (binary, dichotomous), triple and multiple categories. In the logistic regression method, the effects of the independent variables on the dependent variable are calculated as probability and the risk factors are determined as probabilities (Özdamar, 2004). The main difference between the logistic regression and linear regression analysis lies in the regression analysis, while the dependent variable is continuous, logistic regression analysis should be a discrete value (Hosmer & Lemeshow, 2013). Logistic regression is especially used in cases where the dependent variable has two or more values (Zafer, 2014). It is used to find relationships between regression and non-computational variables. It is not possible to make predictions. Using this analysis, it is understandable which parameters of the argument will be entered into which group with a certain margin of error.

The logistic regression model is given in Eq. 1 (Hosmer & Lemeshow, 2013):

$$L = \ln \left(\frac{P_i}{1 - P_i} \right) = \beta_0 + \beta_i X_i + \varepsilon_i, \quad (1)$$

where

- L – logit odds;
- P_i – response variable (estimated probability);
- β_0 – fixed coefficient;
- β_i – argument coefficient;
- X_i – independent variable;
- ε_i – error term.

Logistic regression is a statistical method that provides the possibility of making classification according to probability rules by calculating the estimated values of the dependent variable as probability. In this study, the effect of factors affecting employee commitment (medical report status, disciplinary action, performance and significant inconvenience status) on demographic variables (age, educational status, gender, marital status, residential neighbourhood, number of children, employees by years of employment) was investigated.

Results

The descriptive statistics of the demographic information for the employees is shown in Table 1.

Table 1. Descriptive Statistics for Employees

Variables	Subgroup variables	Number of employees	Percent (%)	Mode	Median
Educational status	Primary school (1)	44	73.3		1
	High school (2)	6	10.0		
	Vocational high school (3)	6	10.0		
	Associate degree (4)	1	1.7		
	License (5)	3	5.0		
	Total	60	100.0		
Gender	Men (1)	59	98.3	1	
	Women (2)	1	1.7		
	Total	60	100.0		
Marital status	Married (1)	51	85.0	1	
	Single (2)	9	15.0		
	Total	60	100.0		
Status	Workers (1)	56	93.3	1	
	Forman (2)	2	3.3		
	Technician (3)	1	1.7		
	Engineers (4)	1	1.7		
	Total	60	100.0		
Medical report	Absent (1)	48	80.0	1	
	Available (2)	12	20.0		
	Total	60	100.0		
Disciplinary penalty	Absent (1)	53	88.3	1	
	Available (2)	7	11.7		
	Total	60	100.0		
Performance	Bad (1)	8	13.3	2	
	Good (2)	52	86.7		
	Total	60	100.0		
Significant inconvenience status	Absent (1)	57	95.0	1	
	Available (2)	3	5.0		
	Total	60	100.0		

According to Table 1, primary school graduates (73.3 %), men (98.3 %), married individuals (85.0 %), workers (93.3 %), without medical report (80 %), without disciplinary penalty (88.3 %), the employees with good performance (86.7 %) and no significant inconvenience (95.0 %) were observed to participate. Figure 1 shows the age distributions of the employees.

In addition, the average age of employees is 38.37, and the highest participation is between 30 and 45 years of age, the majority of the employees (40.0 %) have two children, and 18.3 % do not have children and most of the employees (53.3 %) have been working at the company for 1 year and the employment transformation rate is high.

4. LOGISTIC REGRESSION ANALYSIS FOR REPORTING STATUS

The aim of logistic regression is to determine the cause-effect relationship between dependent variable and independent variables. Table 2 provide the goodness of fit test of Hosmer and Lemeshow and Omnibus test results for the reporting status.

Table 2. Hosmer and Lemeshow Goodness Test and Omnibus Test Results

Test	Chi-Square	Degree of freedom	Significance
Hosmer and Lemeshow	0.83	8	0.56
Omnibus	13.24	7	0.07

In Table 2, the Hosmer & Lemeshow test of the goodness of fit suggests that the model for reporting is compatible ($p = 0.56 > 0.05$). In this model, the chi-square is highly significant (Chi-square = 13.24, $df = 7$, $p = 0.07 > 0.05$) so the model is significantly good, the model for reporting is available. In addition, according to the results of classification table, the overall percentage row shows that this approach to prediction is correct 80 % of the time and the model with the constant is a statistically significant predictor of the outcome ($p = 0.00$).

Table 3 shows the logistic regression table for reporting. Since the standard errors of gender and status were very high in the model, the analysis was made without considering these two variables. This situation can be explained by the sector of the company.

Table 3. Logistics Regression Analysis for Reporting Status

Model	Not standardized		Odds ratio exp. <i>B</i>	Significance
	<i>B</i>	Standard error		
Constant	7.67	4.04	0.06	0.06
Age <i>A</i>	-0.07	0.06	0.93	0.20
Education <i>E</i>	-0.71	0.49	0.49	0.14
Marital status <i>MS</i>	-1.49	1.42	0.22	0.29
Residential <i>R</i>	-0.08	0.09	0.35	0.35
Number of Children <i>NC</i>	-0.85	0.56	0.13	0.13
Year of work <i>YW</i>	-0.16	0.37	0.66	0.66
Status <i>S</i>	-0.18	0.08	0.03	0.03*

* $p < 0.05$.

According to Table 3, it is seen that the only variable affecting the report making situation is the work done by the employee at the enterprise ($p = 0.03$). A regression model of the study is given in Eq. 2:

$$Y_{RS} = 7.67 - 0.07A - 0.71E - 1.49MS - 0.08R - 0.85NC - 0.16YW - 0.18S. \quad (2)$$

According to Eq. 2, all variables affect the model negatively. According to these results, as the age of the employee increases, the level of education increases, the likelihood of receiving reports increases as the number of children and years of work increase.

5. LOGISTIC REGRESSION ANALYSIS FOR DISCIPLINARY PENALTY

Table 4 shows the results of the Hosmer and Lemeshow test that analyses the compatibility of the model and the results of Omnibus test demonstrating the usability of the installed model for the disciplinary penalty statuses in Table 4.

Table 4. Hosmer and Lemeshow Goodness Test and Omnibus Test for the Disciplinary Penalty Status

Test	Chi-square	Degree of freedom	Significance
Hosmer and Lemeshow	16.38	8	0.06
Omnibus	15.70	9	0.07

In Table 4, the Hosmer & Lemeshow test of the goodness of fit suggests that the model for disciplinary penalty is compatible ($p = 0.06 > 0.05$). In this model, the chi-square is highly significant (chi-square = 13.24, $df = 7$, $p = 0.07 < 0.05$) so the model is significantly good, the model for disciplinary penalty status is available ($p = 0.07 > 0.05$). In addition, according to the results of classification table, the overall percentage row shows that this approach to prediction is correct 88.3 % of the time and the model with the constant is a statistically significant predictor of the outcome ($p = 0.00$).

Table 5 shows the logistic regression table for disciplinary penalty. Since the standard errors of education, gender and status were very high in the model; the analysis was carried out without considering these variables. This situation can be explained by the sector of the company.

Table 5. Logistics Regression Analysis for Disciplinary Penalty Status

Model	Not standardized		Odds ratio exp. B	Significance
	B	Standard error		
Constant	1.271	4.107	0.281	0.757
Age A	0.080	0.059	1.084	0.176
Marital status MS	-0.089	1.625	0.915	0.956

Model	Not standardized		Odds ratio exp. <i>B</i>	Significance
	<i>B</i>	Standard error		
Residential <i>R</i>	−0.189	0.129	0.827	0.142
Number of children <i>NC</i>	−1.196	0.659	0.302	0.070
Year of work <i>YW</i>	0.084	0.435	1.088	0.038*
Status <i>S</i>	−0.126	0.098	0.882	0.201

* $p < 0.05$.

According to Table 5, the only variable affecting disciplinary penalty is the number of years the employee works for the company ($p = 0.038$). The regression model of the study is given in Eq. 3:

$$Y_{DP} = 1.27 + 0.08A - 0.09MS - 0.19R - 1.20NC - 0.08YW - 0.13S. \quad (3)$$

According to the model given in Eq. 3, it is seen that all variables except the age negatively affect the model. According to these results, as the level of education of the employee increases, the likelihood of disciplinary penalty decreases as the number of children and working years increases.

6. LOGISTIC REGRESSION ANALYSIS FOR EMPLOYEE PERFORMANCE

Table 6 shows the results of the Hosmer and Lemeshow goodness of fit test that analysis the compatibility of the model and the result of Omnibus test that checks the usability of the installed model in terms of employee's performance.

Table 6. Hosmer and Lemeshow Goodness Test and Omnibus Test for Employee's Performance

Test	Chi-square	Degree of freedom	Significance
Hosmer and Lemeshow	6.35	8	0.61
Omnibus	11.286	6	0.08

In Table 6, the Hosmer & Lemeshow test of the goodness of fit suggests that the model for performance status is compatible ($p = 0.61 > 0.05$). In this model, the chi-square is highly significant (chi-square = 13.24, $df = 7$, $p = 0.07 < 0.05$) so the model is significantly good, the model for performance status is available ($p = 0.08 > 0.05$). In addition, according to the results of classification table, the overall percentage row shows that this approach to prediction is correct 86.7 % of the time and the model with the constant is a statistically significant predictor of the outcome ($p = 0.00$).

Table 7 shows the logistic regression table for performance status. Since the marital status, gender and status standard errors were too high in the model, the

analysis was carried out without considering these variables. This situation can be explained by the sector of the company.

Table 7. Logistics Regression Analysis for Employee Performance

Model	Not standardized		Odds ratio exp. <i>B</i>	Significance
	<i>B</i>	Standard error		
Constant	1.603	2.867	4.966	0.576
Age <i>A</i>	0.119	0.070	1.127	0.090
Education <i>E</i>	0.348	0.705	1.416	0.622
Residential <i>R</i>	−0.080	0.085	0.923	0.347
Number of children <i>NC</i>	−1.245	0.619	0.288	0.044*
Year of work <i>YW</i>	−0.153	0.384	0.858	0.690
Status <i>S</i>	−0.120	0.069	0.887	0.079

* $p < 0.05$

According to Table 7, the only variable affecting employee performance is the number of children that the employee has ($p = 0.044$). The regression model of the study is given in Eq. 4:

$$Y_p = 1.60 + 0.12A + 0.35E - 0.08R - 1.25NC - 0.15YW - 0.12S. \quad (4)$$

According to the model, it is seen that all variables except age and education negatively affect the model. According to these results, the performance of the employee decreases as the number of children and working years increases.

7. LOGISTIC REGRESSION ANALYSIS FOR EMPLOYEE DISCOMFORT

Table 8 shows the results of the Hosmer and Lemeshow goodness of fit test that analyses the compatibility of the model and the results of Omnibus test that checks the usability of the installed model in terms of employee discomfort.

Table 8. Hosmer and Lemeshow Goodness Test and Omnibus Test for Employee Discomfort

Test	Chi-square	Degree of freedom	Significance
Hosmer and Lemeshow	0.44	8	1.00
Omnibus	8.66	5	0.123

In Table 8, the Hosmer & Lemeshow test of the goodness of fit suggests that the model for discomfort is compatible ($p = 1.00 > 0.05$). In this model, the chi-square is highly significant (chi-square = 13.24, $df = 7$, $p = 0.07 < 0.05$) so the

model is significantly good, the model for discomfort is used ($p = 0.123 > 0.05$). In addition, according to the results of classification table, the overall percentage row shows that this approach to prediction is correct 95 % of the time and the model with the constant is a statistically significant predictor of the outcome ($p = 0.00 < 0.05$).

Table 9 shows the logistic regression table for the employee's discomfort. Since the standard errors of education, marital status, gender and status were very high in the model, the analysis was carried out without considering these variables. This situation can be explained by the sector of the company.

Table 9. Logistics Regression Analysis for Employee Discomfort

Model	Not standardized		Odds ratio exp. <i>B</i>	Significance
	<i>B</i>	Standard error		
Constant	−1.551	5.009	0.212	0.757
Age <i>A</i>	−0.011	0.104	0.990	0.919
Residential <i>R</i>	0.141	0.178	1.152	0.428
Number of children <i>NC</i>	0.500	0.921	1.649	0.587
Year of work <i>YW</i>	−0.014	0.553	0.986	0.980
Status <i>S</i>	−0.934	0.858	0.393	0.276

The regression model of the study, according to Table 9, is given in Eq. 5:

$$Y_{ED} = -1.55 - 0.01A - 0.14R - 1.50NC - 0.01YW - 0.93S. \quad (5)$$

According to the model given in Eq. 5, it is seen that all variables except the residential status and the number of children negatively affect the model. According to these results, as the age of the employee and the number of years of employment increase, the likelihood of discomfort is reduced.

CONCLUSION

In the present study, it has been determined whether the employer-employee has a sense of trust, as well as employee's performance, disciplinary action, reporting status and significant inconvenience status have been identified. According to the results, it has been observed that the employees who participated in the survey carried out in the iron and steel company in Karabük were between 30 and 45 years of age. Most of the employees had two children, the turnover rate in the firm was high and the employees generally did not work at the company for many years.

In light of this information, employees' medical reports, disciplinary status, performances and probabilities have been evaluated. The logistic method has been used as the analysis method. It is seen that the only variable affecting the report making situation is the work done by the employee at the enterprise, the variable

affecting disciplinary penalty is the number of years the employee works for the company, the variable affecting employee performance is the number of children that the employee has. As the age of the employee and the number of years of employment increase, the likelihood of discomfort is reduced.

Considering the results obtained, it has been observed that the loyalty of the employees to the employer is not very strong, but at the level of improvement, the employees do not consider working at the company for many years. Employees' wishes, and suggestions should be evaluated by increasing digital data related to employees, establishing an integrated software system and increasing the application of information technologies in human resources management. In addition, in order to reinforce the employee's trust, managers need to change their attitude, they should establish stronger links with their employees, and employees should make necessary arrangements by caring about their ideas and thoughts. Thus, it is expected that sustainable performance management will be facilitated.

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