

## **Statistical Research in Evaluation of Human Resources Performance in Rail Transport**

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**Abstract.** The world economical reality from the last years allows the making evident of some indubitable defining features: the diversification and the renewal of the goods offer, the progresses in the technology area, the globalization occurrence, the growth of clients' and society's exigencies. The analyse of the human resources performance in the railway transport, which is the main goal of this project, aims the identification of the performance indicators of the wage earner on one hand, and on the other hand the presentation of the relations and of correlations between the wage level, the work age, the work conditions and the requirements of the workplaces for the wage earner from the Constanta CFR railway station.

**Keywords.** Performance indicators, rail transport, human resources

### **1. Introduction**

It could be said that the management of the human resources represents the backbone of a modern company, having direct connections with the productivity, performance and success. That's why it should be seen as a direct consequence of a double tendency, not just in the superior performance sphere, but also in re-dimension, in modern organizations, at the perspective of the individual as a distinct entity, (being tied to a social and economical society focused upon the human being), pointed out by the entire human resources problems, which become more and more diverse and complex. In this context, the goal for this research was to give managers patterns, ways and instruments of work for the performance evaluation of the management system of the human resources in the railway transport.

A important aspect of the human resource management is represented by the performance evaluation within the organization, because through evaluation we can better understand the dynamic nature of the professional growth, as some authors had observed [1], evaluation helps us to see the professional growth as a continues process, and not just as a random event that occurs in the life of the employee. Besides this characteristic of the continuity, the evaluation process withholds the complexity attribute, thus, we must assume that anything can be evaluated – even the evaluation can be evaluated.

The application of the evaluation methods must be sustained by the entire managerial group for maximum efficiency. The lack of this support only damages the response to the evaluation. But, not all the research have investigated the effects of implementation upon the managerial systems at RU, I am talking about the growth of the performance of the firm. On the contrary, some scientists say that the general effects of this process are expensive and time consuming [2], or raise the bureaucracy[3]. In

this context, one of the directions of the research is the testing of quantity and quality of the relation between the different practices (methods, techniques and instruments) of the management system of quality and performance of the firm.

## 2. The objects and the relevance of the research

The purpose of the research project “Statistical research in evaluation of human resource performance in rail transport” was to offer managers modules, methods and work instruments in quantity and quality for the evaluation of the performance management system of RU.

The research problem is actual and opportune one because during the market transition, when the preparations were made for Romania to enter the UE, the Romanian organizations must become more efficient if they want to keep up at the new contestants gallop [4]. Or, taking in consideration the implementation of the different systems of management of quality as a way of improving the enterprise, may be an extra chance for the Romanian organizations to stand there ground in the new conditions.

The research problem is tied to a practical problem because it will offer managers methods, models and quantity work instruments for the evaluation of the performance program referred to quality and choosing the best decision. The research problem covers a small researched domain not only in the Romanian Specialty Literature but also on an international scale. Until now, in the specialty literature, the effects of the different practices of management systems of RU were poorly treated. The majority of the studies done for this purpose were quality investigations with the search for the improvement of the quality [5].

The evaluation of the performance of the firm is the foundation for the models of excellence allowing organizations to find strong points, improvement opportunities, and also the systematic monitoring. A proposed research direction represents the development of its own quantities indicators system capable to comprehend the performances of the firm at any modification rate dictated by the implementation stages of the management systems of the RU, respectively the necessary practices. This system of quantities indicators will be constructed, having as a base, on the quality costs and the financial-economical results of the enterprise. Because the indicators needed for the research of the management systems of the RU differs from one branch to another, and in this kind of research it is impossible to go through all the activity sectors within an economy, the author proposes to approach The Transport Railway Branch.

## 3. Research methodology

The analysis of the performance of the human resources in railway transport, which is the main objective of this project, it searches for the performance indicators of the employees and, in parallel, the presentation of the ties and the correlations between the levels of the valorizations, the experience, work conditions and the demands of the post of the employees from the Constanta CFR station. At the same time, we have to determine the elements that will lead to the growth of the performances of the RU in the activity of the railway transport.

The creation of the data folder has at its base the information given by the department of the Human Resources from within the C.N. CFR Regional Infrastructure Constanta. Initially there were only 14 variables (3 nominals and 11 numerical) and these were: name, surname, sex, nationality, salary, age, environment of providence, knowledge level, position, age categories, salary categories, location, marital status and experience. Afterwards there were 3 numerical variables introduced: experience bonus, brut salary and tax.

In the file *BD7sal* the data was introduced in the pages cells *Data View* within the *Data Editor* window opened with the command *New Data*, from the menu *File*. The result of this undertaking is presented in figure no.1.

Figure no.1. The database with the employees of the CFR Constanta

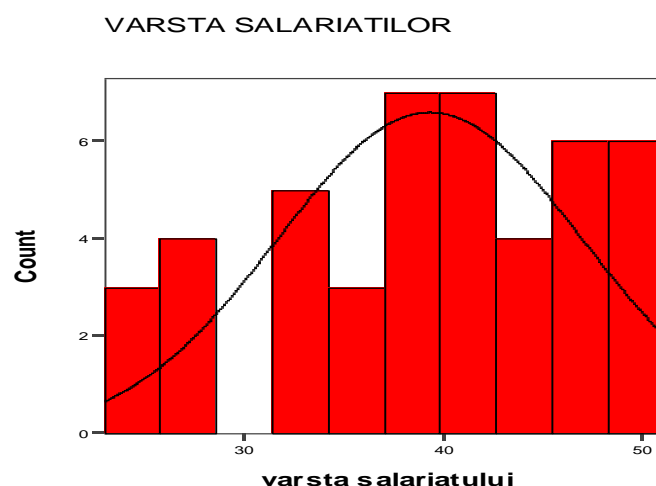
	nume	prenume	varsta	functie	salariu	vechime	studii	stare_civila	sex	nationalitate	mediu	localitate	categ_an	categ_sal
1	balinisteanu	marilena	39	2	1062,00	21,0	2	1	2	1	1	constanta	4	3
2	costea	gabriela	36	1	1093,00	12,0	1	1	2	1	1	constanta	4	3
3	pana	marian	39	2	1062,00	20,0	2	4	1	3	2	techirghiol	4	3
4	bledea	daniela	25	3	1000,00	2,0	2	2	2	3	1	mangalia	1	2
5	barleanu	maria	50	6	733,00	28,0	3	3	2	1	1	constanta	6	1
6	nastuta	florina	39	2	1062,00	16,5	1	2	2	1	2	cumpana	4	1
7	stan	smaranda	44	3	1000,00	24,0	2	3	2	1	1	constanta	5	2
8	mergeani	iuliana	40	6	733,00	18,5	3	1	2	3	1	constanta	4	1
9	gheorghiu	cristina	42	5	842,00	21,0	2	1	2	1	1	constanta	5	2
10	ghilinta	marioara	46	7	561,00	23,0	3	1	2	1	1	fetesti	6	1
11	mosteanu	ion	33	4	1000,00	14,0	1	1	1	1	1	eforie	3	2
12	panait	daniela	37	3	1000,00	17,0	2	1	2	1	1	constanta	4	2
13	stanciu	costica	50	7	561,00	33,0	3	2	1	1	2	cobadin	6	1
14	pop	alexandru	43	2	1062,00	23,0	2	3	1	1	1	constanta	5	3
15	calin	maria	51	6	733,00	33,0	2	4	2	1	2	ciocarlia	6	1

Source: the author

The graphics represent in a synthetic way, under visual form, a static distribution. With the help of the graphics we could have, from a single look, an overall view of the data. The choice of the graphic for the representation of a distribution is made depending on the followed reason and depends, essentially, on the number of the considered variables, and also the their type.

The frequency curve is obtained through the adjustment of the histogram and it is used for the verification of the normality of a distribution. The frequency curve can be overlapped to the histogram, representing the corresponding theory, with the same average and variation.

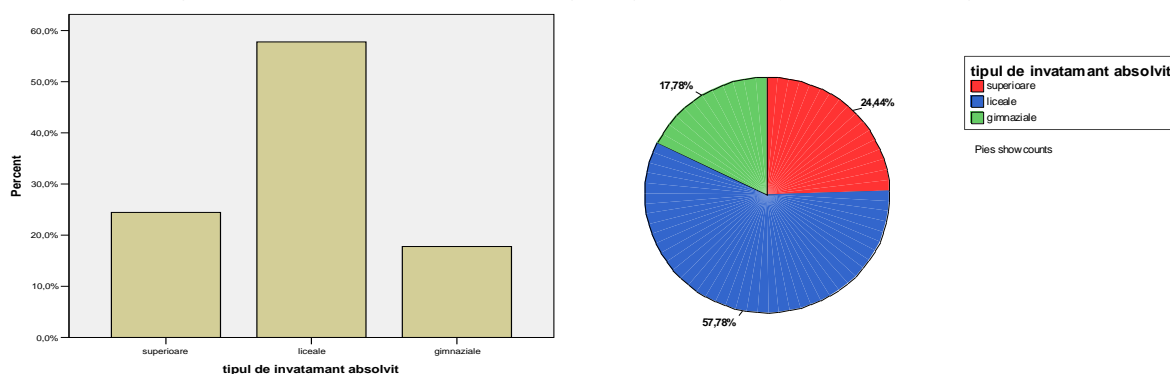
Figure no. 2. The histogram and the Frequency curve for the age variable



Following the construction algorithm, we obtained the histogram for the distribution for the employees after age, from which we can observe, that the list is selected after age on the left, prevailing the adult class. The classes 38-42 and 46-50 years have the highest frequency, adding up to approximately half of the personal volume.

As you can see from the figure number 3, according to the knowledge level the employees with mid-school degrees (57.78%) are more than the ones with superior degrees (24.44%). The structural diagram (Pie Chart) and the bar diagram (Bar Chart) are o way to synthesize a set of nominal data. Each circle sector of the Pie diagram represents a category, its area being direct proportional with the number of cases within this category of the nominal variable. The Bar diagram is often used for the illustration of the categories of a distribution, in a convenient way. The Bar has the same base, equal with the unit, and the height is proportional with the category frequency, as such the area of each bar represents the number of considered categorized cases.

Figure no. 3. The BAR and PIE diagram for the (study) variable using GRAPH



Source: the author

The indicator of the central tendency expresses in a synthetic and generalized way, what is a distribution from the statistics variable point of view. The dispersion represents the scattering phenomenon of the individual values of the X variable, unto the medium level.

The calculus for the central indicators tendency, dispersion and the form for a unique-variety statistic distribution with the help of SPSS can be realized through more than one ways. The mostly used way is: *Analysis* menu, *Descriptive Statistics* command, *Descriptive* option, which opens the dialog box with the same title from which will select the variable/variables for which we wish to calculate the distributions parameters, also the indicators that follows the calculus.

Table no. 1. The distribution parameters employees' age and framed salary

Descriptives				Descriptives			
		Statistic	Std. Error			Statistic	Std. Error
varsta salariatului	Mean	39,24	1,136	salariul de incadrare	Mean	926,1333	28,72054
	95% Confidence Interval for Mean	Lower Bound	36,96		95% Confidence Interval for Mean	Lower Bound	868,2509
		Upper Bound	41,53			Upper Bound	984,0158
	5% Trimmed Mean	39,49	5% Trimmed Mean		929,7654		
	Median	40,00	Median		1000,0000		
	Variance	58,053	Variance		37119,118		
	Std. Deviation	7,619	Std. Deviation		192,66322		
	Minimum	23	Minimum		561,00		
	Maximum	51	Maximum		1392,00		
	Range	28	Range		831,00		
	Interquartile Range	13	Interquartile Range		329,00		
	Skewness	-,491	,354		Skewness	-,521	,354
	Kurtosis	-,569	,695		Kurtosis	-,252	,695

Source: the author

#### 4. Interpretation of research results

The asymmetrical coefficient (skewness) in the case of the variable “age”, it starts from -1 and ends at 0. This shows the presence of a negative asymmetrical distribution, with a left departure. This result came from the histogram for the same variable. The same interpretation is for the distribution after “framed salary”.

The bolt coefficient (kurtosis) is a spreading measure of each observation around a central value. In our case, for both variables it is negative, thus indicating a weaker grouping around the central value, the frequency curve is more flattened and the name of the distribution is “*platicurtiaue distribution*”.

For the “age” variable, the average is 39.24 years, very close to the median (40 years), and the standard departure (sigma) is 7.69 years has a lower value, and in the same time we can say that the value is next to medium. In this case the interpretation is this one: because the differences of the medium aren’t that big, it results that the average is representative for the table chosen as a database.

For the variable “*framed salary*” the average is 926.1333euro (brut), the trust interval for the average (the time when most of the persons are included) is 868.25 – 984.01 euro. The default deviation (192.66 euro) has a small value compared with the average, thus the deviation coefficient having a value under 35% this meaning that the populace is approximately homogeneous, there is a weak concentration of values around the average, so the average is approximately representative. On the other hand, the negative asymmetrical coefficient indicates the presents of a negative asymmetrical distribution, with a left departure, in the meanwhile the negative kurtosis suggest the fact that frequencies have a flattered curve, and the distribution is platicurtique, as the distribution after “age”.

The frequency distribution “salary categories\*age categories” explains the distribution of the simultaneously observed persons after two considered variables, meaning they show how many persons from each age category have a certain level of income. On the example presented on the 5<sup>th</sup> table we can notice that no persons with the age between 31 – 35 years hasn’t got their salary lower than 800 euro, meanwhile in the 45 years group the most of them (8) have lower salaries than 800 euro.

Table no. 2. Distribuția de frecvență “categoriile de salarii\*categoriile de vârstă”

Count Salarial brut (Euro)	categoriile de varsta						Total
	<25 ani	26-30 ani	31-35 ani	36-40 ani	41-45 ani	>45 ani	
categoriile de salarii <800	1	1	0	4	2	8	16
801-1000	1	0	2	3	4	3	13
1001-1200	1	3	3	5	2	1	15
>1201	0	0	0	1	0	0	1
Total	3	4	5	13	8	12	45

Source: author

In SPSS, the testing of two averages can visas either the case of two independent populations, or the case of two dependent populations (groups). *Independent-Sample T Test* is a method which is applied in the case of independent tables. Through this procedure we test if the averages of two groups are equal. Undertaking the test following SPSS is: Analysis menu – Compare Means command – *Independent Sample T test* option. The statistical calculus for the collation of two populations is achieved if the standard deviations at the level of the two groups are different significantly, because through the null theory the two populations have equal variance.

We will make two tests: one referred to the average salary, in which, through the null hypothesis we will presume that the salaries of the two groups (urban, rural) don’t differ significantly and a second test referred to the salary framed on the sex, in which we will assume through the null hypothesis that there are no big salary differences between males and females.

After we applied the *Independent-Sample T Test*, for the first case, we obtained test  $t = 1,139$ , with 43 liberty grades and a probability of Sig. De 0.228 (greater than 0.05), which shows us that for the average of these two groups (urban - 946.90 euro and rural – 875 euro) we cannot draw the conclusion

that they differ significantly, thus the null hypothesis is accepted. At the same result we arrive observing the differences between the two values. The interval contains the 0 values, as a result we cannot draw the conclusion that the difference between the averages values of the two groups differ significantly (table no. 3).

After applying the Independent-Sample T Test procedure for the second case we obtained t test with 2.321, with 43 liberty degrees and with a Sig. probability of 0.007 (smaller then 0.05), that shows us that for the two (masculine groups – 1007.70 euro and feminine – 876.60 euro) we can understand that they greatly differ, the null hypothesis, through which there average equality was thought, being denied. At the same findings we arrive if we observe the trust interval for the difference of the two values.

Table no. 3. The Independent Sample T Test output for the “framed salary-environment”

Group Statistics									
		mediu	N	Mean	Std. Deviation	Std. Error Mean			
salariul de incadrare	urban		32	946,9063	186,89869	33,03933			
	rural		13	875,0000	204,64970	56,75961			

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
salariul de incadrare	Equal variances assumed	1,498	,228	1,139	43	,261	71,90625	63,15397	-55,45586	199,26836
	Equal variances not assumed			1,095	20,594	,286	71,90625	65,67535	-64,83709	208,64959

Source: the author

The interval doesn't include the 0 values; as a result we can understand that the difference between the average values differs greatly (table no 4).

Table no. 4. Independent Sample T Test output for the “framed salary-sex”

Group Statistics									
		sex	N	Mean	Std. Deviation	Std. Error Mean			
salariul de incadrare	masculin		17	1007,7059	142,20222	34,48910			
	feminin		28	876,6071	204,38695	38,62550			

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
salariul de incadrare	Equal variances assumed	7,883	,007	2,321	43	,025	131,09874	56,48959	17,17662	245,02086
	Equal variances not assumed			2,532	42,079	,015	131,09874	51,78250	26,60322	235,59426

Source: the author

The testing of the correlations coefficient starts from the hypothesis that there is no correlation between the variables. The hypothesis verification  $H_0$  is made with the help of the t test for the simple correlation coefficient. The calculated value of t is compared with the theoretical value taken from the t table (Student), for n-2 liberty degrees and the set significant level. If  $t_{calc.} > t_{table}$ , then the  $H_0$  is denied, and the conclusion is, normally with a considerable risk (5%), that the value of the correlation coefficient is not equal with 0; meaning, that between the researched variables there is a significant tie, this meaning that the correlation coefficient is significantly statistic.

For the correlation analysis to take place we will consider two distinct cases: we will study the correlation between tax and the age of the employee, on one side, and on the other side the correlation between tax and brut salary (knowing that they are strong depended, because the tax is obtained from the brut salary through the application of the 16% quota). Undertaking each case separately in SPSS: *Analysis* menu – *Correlate* command – *Bi-varied* option.

For the correlations analysis between the *age and tax* variables, through the  $H_0$  hypothesis we assume that there is no tie between the paid tax by each employee and his age. Undertaking the data we will have:

Table no. 5. Output SPSS for the correlation analysis

		Correlations	
		varsta salariatului	IMPOZIT
varsta salariatului	Pearson Correlation	1	-,365*
	Sig. (2-tailed)		,014
	N	45	45
IMPOZIT	Pearson Correlation	-,365*	1
	Sig. (2-tailed)	,014	
	N	45	45

\*. Correlation is significant at the 0.05 level (2-tailed).

Source: the author

*Interpretation.* For the considered example, we obtained a Pearson correlation coefficient equal with -0.365, suggesting that the between the variables there is a inverse correlation, weak, the coefficient's value being negative and closer to 0 than it is to 1. The coefficient's correlation test it is done with the help of the t test. The Sig. corresponding value, equal with 0.014, is smaller than 0.05, accepting the null hypothesis, meaning that between the two variables (tax and age) there is no significant correlation.

To example this kind of correlation we chosen a second case, in which I want to analysis the correlation between *tax and brut salary*. Through the  $H_0$  hypothesis I presume that there is no connection between the paid tax by each employee and the brut salary. Undertaking, we have:

Table no. 6. Output SPSS for the correlation analysis (second case)

		Correlations	
		IMPOZIT	SAL_BRUT
IMPOZIT	Pearson Correlation	1	1,000**
	Sig. (2-tailed)		,000
	N	45	45
SAL_BRUT	Pearson Correlation	1,000**	1
	Sig. (2-tailed)	,000	
	N	45	45

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Source: the author

*Interpretation.* For the considered example, we have a Pearson correlation coefficient equal with, this meaning that between the variables there is a direct link, perfect, the coefficient value being positive and exactly 1.

## 5. Conclusions

The objective of project “Statistical Research in Evaluation of Human Resources Performance in Rail Transport” was to offer managers templates, methods, quantity and quality work instruments for the evaluation of the quality management system.

Among the top contributions of research for the development of knowledge in the area of expertise we can remember:

- The development of a conceptual frame and a coherent research methodology, which will permit the quantity and quality study of the system management performance of quality in the rail transport.
- The base terminology for the classification and systematization of the system management performance of quality.
- Broadening the known horizon and the development of the existing information volume in the appreciation of the system management performance of quality.
- The discussions of certain models and performance evaluation existent in the specialty literature.
- The development of an own model of system management performance quality.
- The construction of relevant performance indicators for the performance evaluation of the quality management system.

As a direct future research, the author proposes to develop and implement a soft which will permit the constant monitoring of the system management performance of the RU with specific quantitative indicators. It is certain, that this informatics system will accumulate, classify, sum up and rapport that information which will stand as a base for the decision making and the planning of the activities referred to the quality of an organization. The construction of an informatics system will remove manual work of the collected data, and the information’s user will have the possibility to “glide” from analytic to synthetic, and vice versa, the essential conditions for a good real knowledge of the firm.

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