QUANTITATIVE METHODS IN ECONOMICS
Vol. XIV, No. 1, 2013, pp. 15 – 26

HUMAN RESOURCES ANALYSIS USING A DECISION SUPPORT SYSTEM

Aneta Becker
Department of Economics
West Pomeranian University of Technology in Szczecin
e-mail: aneta.becker@zut.edu.pl
Jarosław Becker
Department of Information Technology
West Pomeranian University of Technology in Szczecin
e-mail: jbecker@wi.zut.edu.pl

Abstract: This paper presents the results of the analysis of labour resources in the sample manufacturing company. The process consisted of: scheduling, grouping, and assessment of personnel taking into account the criteria and preferences of executives. Solutions were obtained using the decision support system DSS 2.0.

Keywords: Analysis of human resources, ranking, clustering, decision support system.

INTRODUCTION

In the modern managed organization, managing people plays an important role. The management of such capital requires the proper use of knowledge, skills and talent and motivation for a better job, change and progress. Properly trained and competent staff is dynamic and active part of the resources of each company. Resource management work should be continuously improved since their quality is depreciated. [Penc 2007]

This article aims to analyse manual workers (fitters) from a sample production company. The scope of research is subject to DSS 2.0 system functions and is designed to highlight its relevance for supporting personnel and payroll decisions. The experiment takes into account the criteria and preferences of executives. The analysis includes: ranking of employees and the distribution of bonus fund, evaluation of the structure of the crew and the individual evaluation of the results com-

pared to the level of wages. In addition, through simulation, a marginal increase in the value of the criteria for the crewmembers who would like to be included among the best is sought for.

MANAGEMENT OF HUMAN RESOURCES IN ORGANIZATION

The issues related to the acquisition of the right people and the effective use of their knowledge and skills to fulfil the objectives of the organization have long been the subject of research and practical solutions. Today, discussion of the place and role of the people in the organization defines the approach defined as the management of human resources. [Pocztowski 2008]

According to A. Pocztowski, people are the most important resource of the organization, and effective management is the key to success [Pocztowski 2000]. The concept of human resource management is understood strategically and a coherent approach to the management of organization's most valuable assets, which are employees, who individually and collectively contribute to the achievement of the objectives of the organization [Armstrong 2005]. On the other hand, personnel management is a philosophy that defines the way in which staff should be treated that such measures are consistent with the interests of the organization. Therefore, the approach can be divided into the „hard" and „soft" ones in human resource management. „Hard" approach emphasizes quantitative, strategic, business and spread sheet aspects. The staff is treated like other resources at the disposal of the organization and the organization invests in it as in the new technology [Armstrong 2005], [Król, Ludwiczyński 2006]. However, in terms of „soft" approach, the management is communication, leadership and motivation. The approach of the staff is more subjective than the subject. Great importance is attached to the culture and the employees who are members of one team, strive to achieve the goals set by the company. Most organizations, however, use the combination of „hard" and „soft" human resource management policies [Armstrong 2005].

Human resource function is the most important function of any organization. It contains all the activities of the personnel working in the company. The management of personnel consists of HR processes whose distribution depends inter alia on the size of the organization, its organizational structure, location, management philosophy and business. Among the key HR processes running in the company the following must be distinguished: beginning of work, work, and end of work [Pocztowski 2008].

EVALUATION OF WORK IN THE ORGANIZATION

An important function of personnel management is to evaluate employees, which consists of an expression in the form of oral or written evaluative view of their personal characteristics, behaviour and effects of work. Assessment of work can be done on a regular basis by supervisors or co-workers for example,

and using a pre-prepared often formalized system of periodic evaluations of employees[Pocztowski 2008]. The main modules of the system evaluation of employees include: assessment purposes, methods of application, subject and object, the criteria, methods and techniques [Encyclopaedia of ... 1981].

One can distinguish the following evaluation of objectives:

- administration, the results are used to shape the personnel policy relating to: the hiring of workers, movement of employees within the company and compensation of employees;
- Information, data on employees' work are transmitted to managers, and information about the weaknesses and strengths to employees;
- motivation, the intention is to provide employees with information to motivate them to develop their personal skills and improve the efficiency of their work. [Anderson, 1993]

The technique of assessment, which is defined as the intentional way of making employee evaluations in the scope of the adopted criteria, should be mentioned. Among the most popular techniques are distinguished: ranking, pair wise comparison, the normal distribution method, normal recording, comparison with standards, techniques of critical events, check-lists, point scale, behavioural scales, management by objectives and assessment questionnaires [Szałkowski 2000].

Evaluating employees and, consequently, positive reinforcement and suppression of undesirable behaviour shapes relationships and increases organizational culture within the company. The managers and employees themselves and the persons responsible for the company's personnel and international institutions (trade unions) and external (National Labour Inspectorate), are interested in the opinion.

RESULTS OF DECISION ANALYSIS OF WORKERS

The study used a hypothetical „PRYM" company information, which specializes in the design, manufacturing and installation of steel structures, particularly steel buildings. It manufactures steel structures including: chimneys, silos, roof trusses, steel or composite construction, beams, floors, mezzanines and poles. It prepares own designs, or uses the documentation provided by the developer. The company has a dedicated and experienced staff and engineering and managerial personnel. The 50-people company is managed by the director. He is the immediate superior of a proxy for the quality, production director, quality controller and chief accountant, who in turn manages the accounting department and human resources (employee for the payroll and inspector for the Industrial Health and Safety). Production Manager manages production department and the immediate superior technical staff and production manager, who is head of supply staff, a warehouse and master. The latter is responsible for the work of a 40-people team performing physical work.

The study was conducted using the DSS 2.0 system (*Decision Support System*) developed in Szczecin universities (author: Budziński R., Becker J., version 2.0.098, 2013).The system is used to solve complex decision problems, which are dealt with in different homogeneous collections of objects. The concept has a dimension of abstract objects, in fact, they take on a specific form to represent, for example, objects, entities (people, organizations), factual events, objective scenarios (general – options for decision-making). The system enables the optimal choice, ordering and grouping objects according to a fixed structure criteria and preferences. Its functionality includes the analysis and econometric evaluation of objects, and found among them linguistic accuracies, using rough set theory.

Analysis of the staff was subordinated to system functions as a way to highlight the usefulness of the system for decision support personnel and payroll. The test procedure consisted of:

A. determining the structure of the evaluation criteria and give them preference
B. ranking employees and the distribution of bonus fund,
C. simulating the competitiveness of the workforce – the search for the adjustment of the minimum criteria for assessing the employee with a lower score with the top-rated crew members,
D. grouping of employees and assessment of the quality of the structure of the crew,
E. econometric assessment of the level of individual salaries.

A. The criteria and preferences

Persons performing work are evaluated. Therefore, there are four groups of criteria used during the operation, namely:

- efficiency criteria – relating to performance,
- eligibility criteria – depending on the job,
- behavioural criteria – regarding behaviour,
- personality criteria – including traits of intellect and character.

In this example, the evaluation was performed on workers, who were fitters, which is one of the main occupations in the metal and engineering industry. A fitter deals with manual or manual-machine metal processing. Fitter, in addition to the skills of mechanics, such as the removal and installation of equipment, cutting, sawing, drilling, riveting and soldering must master basic skills in the field of electrical engineering and hydraulics and metallurgy.

Among these groups of criteria for evaluating the first three were selected. Detailed information on each criterion are presented in Table 1 The analysis began by evaluating the performance of employees (d_1), which measured the amount of pieces of product made in one month ($d_{1.1}$) and the number of products with defects ($d_{1.2}$). The criterion of productivity achieved the highest priority (w_1= 0,45), as the data on the productivity of workers have the greatest impact on the system of rewards and punishments, the organization of the necessary training, which translates

into increased productivity to the desired level, and awarded promotions and decisions on exemptions. The second group formed the eligibility criteria (d_2), which, due to the importance of the assessment system gained importance w_2= 0,35 Used in the study: work experience ($d_{2.1}$), familiarity with the devices ($d_{2.2}$) and physical condition ($d_{2.3}$). The next step concerned in the behavioural assessment (on behaviour) – d_3, with the weight w_3 = 0.15. In this group we find the following professional attitudes: accountability ($d_{3.1}$) initiative ($d_{3.2}$) and discipline ($d_{3.3}$). Acceptance of these evaluation criteria required by the employees that they are clearly defined and focused on behaviour, not personality traits [Assignment 2011]. This leaves the last group that formed personality traits, including intelligence traits, such as: memory, intelligence, capacity for analysis and synthesis, and the following character traits: activity level, emotionality, self-confidence, and sensitivity to criticism. Additionally, the skills assessment criterion was system introduced in to the system (d_4) with the weight of w_4= 0,05, for example: driver's license, certificates, courses, and foreign language skills. All the weighting factors at the level of the main criteria and sub-criteria were determined by the Saaty's method [Saaty 1980]. The degree of consistency of and assessments expressed in spot-verbal ratings measured by the convergence of coefficient CR for the main criteria was 0,068. It should be noted that the values of sub-criterias: $d_{1.1}$, $d_{1.2}$and $d_{2.1}$were introduced into the system at different units measurement and were transformed to the scale of 0-10.

Table 1. The structure of the evaluation criteria of fitters

Criteria and sub-criteria	Weighting factors
d_1 - Performance of employees [points]	w_1 = 0,45
$d_{1.1}$ - Measured the amount of pieces of product made in one month [pcs/month]	$w_{1.1}$ = 0,50
$d_{1.2}$ - The number of products with defects, which measured in month [pcs/month]	$w_{1.2}$ = 0,50
d_2 - Professional qualifications [points]	w_2 = 0,35
$d_{2.1}$ - Work experience [number of years]	$w_{2.1}$ = 0,27
$d_{2.2}$ - Familiarity with the devices [points]	$w_{2.2}$ = 0,54
$d_{2.3}$ - Physical condition [points]	$w_{2.3}$ = 0,19
d_3 - Professional attitudes [points]	w_3 = 0,15
$d_{3.1}$ - Accountability [points]	$w_{3.1}$ = 0,25
$d_{3.2}$ - Initiative [points]	$w_{3.2}$ = 0,50
$d_{3.3}$ - Discipline [points]	$w_{3.3}$ = 0,25
d_4 - Additional skills [points]	w_4 = 0,05

Source: own research

B. Allocation of bonus fund was based on the ranking of employees

Evaluation of fitters employed by the „PRYM" company was carried out in connection with the division of the bonus fund of PLN 20,000. By a simple weight additive method, available in DSS 2.0 system, a ranking of personnel, along with three examples of variations of the allocation of the premium was received – Table 2.

Table 2. Ranking of fitters with allocation of bonus variants

Obiekt	Nazwa potoczna	OZM(100%)	OZM (50%)	OZM (37%)	S	P	Sumy EMP	*Oceny PRF	[R]
AA0006	Pracownik 6 - filia 1 ...	3,450 -	1,725 -	1,277 -	-	-	27,400	31,191	1
AA0002	Pracownik 2 - filia 1 ...	2,900 -	1,450 -	1,073 -	-	⊗	32,500	30,763	2
AA0011	Pracownik 1 - filia 3 ...	3,990 -	1,995 -	1,476 -	-	-	28,400	30,404	3
AA0005	Pracownik 5 - filia 1 ...	3,560 -	1,780 -	1,317 -	-	⊗	30,200	29,784	4
AA0001	Pracownik 1 - filia 1 ...	2,980 -	1,490 -	1,103 -	-	⊗	29,300	28,234	5
AA0009	Pracownik 3 - filia 2 ...	3,330 ⊗	1,665 -	1,232 -	-	-	23,300	27,902	6
AA0007	Pracownik 1 - filia 2 ...	3,950 ⊗	1,975 -	1,462 -	-	-	26,500	27,807	7
AA0008	Pracownik 2 - filia 2 ...	3,680 ⊗	1,840 -	1,362 -	-	-	23,900	27,398	8
AA0013	Pracownik 3 - filia 3 ...	3,060 ⊗	1,530 -	1,132 -	-	-	21,600	26,455	9
AA0010	Pracownik 4 - filia 2 ...	3,060 ⊗	1,530 -	1,132 -	⊗	-	19,500	24,746	10
AA0012	Pracownik 2 - filia 3 ...	3,020 ⊗	1,510 -	1,117 -	⊗	-	19,200	24,237	11
AA0003	Pracownik 3 - filia 1 ...	2,670 ⊗	1,335 -	0,988 -	-	⊗	23,100	22,105	12
AA0014	Pracownik 4 - filia 3 ...	2,860 ⊗	1,430 ⊗	1,058 -	⊗	-	18,400	21,427	13
AA0004	Pracownik 4 - filia 1 ...	2,710 ⊗	1,355 ⊗	1,003 -	⊗	-	16,800	20,851	14
AA0016	Pracownik 6 - filia 3 ...	2,670 ⊗	1,335 ⊗	0,988 -	⊗	-	14,400	18,389	15
AA0015	Pracownik 5 - filia 3 ...	2,670 ⊗	1,335 ⊗	0,988 -	⊗	-	12,500	15,370	16
AA0017	Pracownik 7 - filia 3 ...	2,630 ⊗	1,315 ⊗	0,973 -	⊗	⊗	14,800	13,693	17

Source: own using AHP module in the DSS 2.0

Each column headings are:

- [R] – ranking position,
- PRF assessments (pl *oceny PRF*) –weighted sum of points received by the employee on criteria,
- EMP sums (pl *sumyEMP*) – sum of points earned by the employee on the criteria (excluding preference, or with equal weights),
- P – information on a comparison of the values in column „PRF assessments" of „EMP sums" sign „⊗„ indicates that, for a given t employee (t = AA0001, AA0002, ..., AA0017) $prf^{(t)}$ note is less than $emp^{(t)}$, indicating greater participation in the evaluation of $prf^{(t)}$ points obtained in criteria less favoured by decision-makers,
- S – the results of comparing the $emp^{(t)}$ with the minimum level, the threshold $emp_{min} := emp_{max} \times S_{min}$ determined by the decision maker, sign '⊗' means that the employee did not receive a score determined by the decision makers S_{min} = 50% of the maximum points emp_{max}= 40, i.e. emp_{min} = 20 points,

- OZM – the bonus amount, acting in subsequent columns of interest: 100%, 50% and 37% of base salary („⊗„–no bonus awarded to the employee),
- 'Nazwa potoczna' – name of object, 'Objekt' – id of object.

As a result of simulation, it was observed that if the bonus was 100% of basic salary, it was granted to 5 best employees. Reducing the amount of award by 50%, caused five employees with the weakest did not receive a bonus. On the other hand, when the bonus was 37% of the basic salary, the extra money could be given to all employed fitters.

C. Simulation studies of competitiveness of employees

In the decision support common way of obtaining the best solutions from the point of view of the trustee is to use optimization methods. The system's DSS 2.0 exemplary structure of a WPL mathematical model has a large, theoretically unlimited potential for information. It allows describing the decision-making situation (including variants of decision) by the ability to define a number of decision variables, balances and limitations of resources and a lot of partial functions representing the selection criteria and preferences given to them. [Becker 2008]

In DSS 2.0 a fitter was represented by a simple mathematical model of partial linear programming, constructed on the basis of predefined template (Fig. 1). Automatic connection of specific partial models into one multimodel of linear programming allowed, through optimization of solving various scenarios of selecting employees. The template assumes that every fitter t = AA0001, AA0002, ..., AA0017 is represented by a binary variable of type 'X01_Wybór' and the vector of technical and economic parameters [c_2, c_3, d_1, d_2, d_3, d_4].

It was assumed that in the „PRYM" company at the end of the quarter, five best-rated employees would receive the bonus. At the beginning of the period the value cc1 = 5 was set in the system and potential leaders were selected. Employees who have not been admitted to the preferred leaders were able to improve their ratings using *subsystem simulation of appeal* included DSS 2.0. Its task is to find the minimum value of which the main criteria need to be corrected, so the employee has to compete with the leaders and earned a chance to win the next outcome (session optimization). Simulation algorithm provides three strategies to seek new values that vary in the order for amendments to the vector of criteria.

1) *Strategy A* – Annotating amendments starts from the least important criterion and can last until the threshold value, then modified in the same way more and more important criteria until exhausted.
2) *Strategy B* – Annotating amendments starts from the most important criterion and can last until the threshold value, then modified in the same way less and less important criteria until exhausted.
3) *Strategy C* (collectively, whole vectors) – Single corrections are applied to all of the criteria, the process can be repeated until the achievement of limit values around the vector.

Figure 1. Preview of the template of a mathematical model to choose a fitter

SZABLON [DSS033_000000]

ID	BILANSE	JM	X01_Wybór	F01_...	F02_...	F03_...	F04_...	R	WO
B01	¤Pracownik	Osób	1,000					<=	bb1
C01	¤Liczba pracowników	Osób	1,000					<=	cc1
C02	¤Stawka za roboczogodzinę ...	Osób	c2					<=	cc2
C03	¤Pensja	Tys.z	c3					<=	cc3
D01	Wydajność pracy	Pkt	d1	-n1				==	0
D02	Kwalifikacje zawodowe	Pkt	d2		-n2			==	0
D03	Postawa zawodowa	Pkt	d3			-n3		==	0
D04	Dodatkowe umiejętności	Pkt	d4				-n4	==	0
CEL	FUNKCJA WPL			a01	a02	a03	a04	=>	MAX

Source: the module of generator of WPL decision-making models in the DSS 2.0

It was assumed, for example, that the appeal system was used by three fitters, had the following places in the ranking: 6th, 12th and 17th place. The system juxtaposed the model describing each employee who was out of the leas with the leaders' models. Through optimization proposals for improving the criteria to guarantee entry to the group of winners were achieved. For example, analysing the situation of the worker, who took 6th place, it was advantageous to use scenario A. Disclosure of additional skills allowed him to move to the leaders with the least difficulties. For fitters, who were in the further positions, more advantageous was to select scenario B and C and their subsequent variants with reduced upper range of criteria.

Table 3. Simulation results of fitters' competitiveness – correction of notes

Id	Name	Position in the ranking	Main criteria	Values of the criteria [point]			
				Real	Simulated by algorithm		
					A	B	C
AA0009	Employee 3 - department 2	6	d1 - Performance of employees	8,0	8,0	8,2	8,1
			d2 - Professional qualifications	6,5	6,5	6,5	6,6
			d3 - Professional attitudes	6,8	6,8	6,8	6,9
			d4 - Additional skills	2,0	3,6	2,0	2,1
AA0003	Employee 3 - department 1	12	d1 - Performance of employees	6,7	6,7	10,0	8,3
			d2 - Professional qualifications	3,8	5,9	4,0	5,4
			d3 - Professional attitudes	5,6	10,0	5,6	7,2
			d4 - Additional skills	7,0	10,0	7,0	8,6
AA0017	Employee 7 - department 3	17	d1 - Performance of employees	3,6	3,6	10,0	7,3
			d2 - Professional qualifications	3,1	9,8	5,3	6,8
			d3 - Professional attitudes	3,1	10,0	3,1	6,8
			d4 - Additional skills	5,0	10,0	5,0	8,7

Source: own using WPL decision simulation module in the DSS 2.0 system

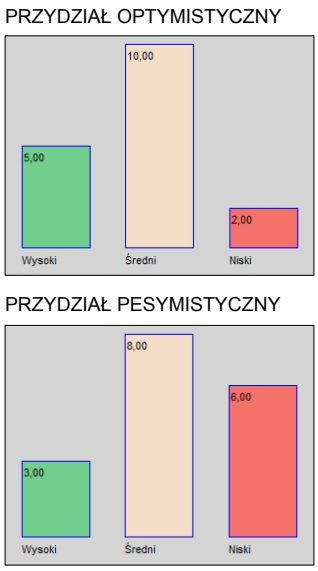
D. An analysis of the quality of staff assessed

The next stage of the research was to allot fitters to three defined preferences classes: high, average and low. For this purpose, the ELECTRE TRI method was used [Roy, Słowiński 2008]. This procedure was designed to answer the following questions: what is the structure of the distribution of the crew, and is it consistent with the order obtained in the rankings, what category are the leaders of the ranking, whether they are high, average or low preferred fitters?

The system grouped employees in terms of preferences adopted to three quality grades: AB –low (pl *niski*), BC – medium (pl *średni*), CD – high (pl *wysoki*). Cut-off factor (level of evidence) was λ=0.76. According to the ELECTRE TRI method the allocation of options to designated classes was made using optimistic and pessimistic procedures (Table 4).

Table 4. Result of analysis of the quality structure of the crew – the division into three groups

Obiekt	Nazwa potoczna	O	OPTYMIZM	PESYMIZM	P
AA0006	Pracownik 6 - filia 1 ...	DE	Wysoki	Wysoki	DE
AA0002	Pracownik 2 - filia 1 ...	DE	Wysoki	Wysoki	DE
AA0011	Pracownik 1 - filia 3 ...	DE	Wysoki	Wysoki	DE
AA0005	Pracownik 5 - filia 1 ...	DE	Wysoki	Średni	CD
AA0007	Pracownik 1 - filia 2 ...	DE	Wysoki	Średni	CD
AA0001	Pracownik 1 - filia 1 ...	CD	Średni	Średni	CD
AA0009	Pracownik 3 - filia 2 ...	CD	Średni	Średni	CD
AA0008	Pracownik 2 - filia 2 ...	CD	Średni	Średni	CD
AA0013	Pracownik 3 - filia 3 ...	CD	Średni	Średni	CD
AA0010	Pracownik 4 - filia 2 ...	CD	Średni	Średni	CD
AA0012	Pracownik 2 - filia 3 ...	CD	Średni	Średni	CD
AA0003	Pracownik 3 - filia 1 ...	CD	Średni	Niski	BC
AA0014	Pracownik 4 - filia 3 ...	CD	Średni	Niski	BC
AA0004	Pracownik 4 - filia 1 ...	CD	Średni	Niski	BC
AA0016	Pracownik 6 - filia 3 ...	CD	Średni	Niski	BC
AA0015	Pracownik 5 - filia 3 ...	BC	Niski	Niski	BC
AA0017	Pracownik 7 - filia 3 ...	BC	Niski	Niski	BC



Source: own using Electre Tri module in the DSS 2.0 system

Two applied approaches gave a slightly different division of employees. In the optimistic approach (Fig. in Tab. 4, pl *'PRZYDZIAŁ OPTYMISTYCZNY'*), there were 5 people highly preferred, 10 medium and 2 low. However, in the pessimistic procedure (fig. in tab. 4, pl *'PRZYDZIAŁ PESYMISTYCZNY'*) 3 people were highly preferred, 8 average, and the remaining low. The differences in allocations signalled the existence of certain ambiguities. Practically, in such situation, the final allocation is done by the decision-maker. Taking into account these two allocations, it was proposed to group the employees into five classes. Among the most

favoured people were 3 employees, in the next class 2, the average group consisted of 6, while in the 4th class there 4 fitters, the last, lowest group contained 2 people. The resulting divisions were similar to the order obtained during the distribution of bonus fund (Stage B). Three out of five workers belonging to the leaders were definitely classified as a highly preferred group, one was on the border between the high and average class, and one was included in the group of averagely preferred.

E. Econometric analysis of the level of remuneration

Econometric analysis of the level of remuneration in the „PRYM" company included an examination of the effectiveness, which consisted of designing properly fitted econometric model describing the impact of the evaluation criteria of *t* employees at the level of their hourly rate of pay.Regarding the actual values of individual wages y_t('OZM' in Table 5) for each *t* employee to the dependent variable $\hat{y}_t$, one can measure economic efficiency.

Table 5. The results of the econometric analysis of wage levels (rate per hour)

Obiekt	Nazwa potoczna	D01...	D02...	D03_...	D04_...	Ocena	OZM	OS	R
AA0014	Pracownik 4 - filia 3 ...	6,900	4,200	4,300	3,000	WW	9,400	9,000	1
AA0011	Pracownik 1 - filia 3 ...	6,800	9,000	7,600	5,000	Wn	10,200	10,000	2
AA0003	Pracownik 3 - filia 1 ...	6,700	3,800	5,600	7,000	Wn	9,200	9,000	3
AA0006	Pracownik 6 - filia 1 ...	8,500	7,300	8,600	3,000	Pw	10,100	10,000	4
AA0004	Pracownik 4 - filia 1 ...	5,500	6,200	3,100	2,000	Pw	9,100	9,000	5
AA0008	Pracownik 2 - filia 2 ...	7,600	6,500	6,800	3,000	Pw	10,100	10,000	6
AA0005	Pracownik 5 - filia 1 ...	6,900	7,300	10,000	6,000	Pn	9,900	10,000	7
AA0009	Pracownik 3 - filia 2 ...	8,000	6,500	6,800	2,000	Pn	9,900	10,000	8
AA0007	Pracownik 1 - filia 2 ...	5,600	8,500	8,400	4,000	Pn	9,900	10,000	9
AA0015	Pracownik 5 - filia 3 ...	3,900	4,500	3,100	1,000	Nw	8,800	9,000	10
AA0016	Pracownik 6 - filia 3 ...	4,100	6,500	2,800	1,000	Nw	8,800	9,000	11
AA0013	Pracownik 3 - filia 3 ...	7,900	6,100	5,600	2,000	Nw	9,700	10,000	12
AA0012	Pracownik 2 - filia 3 ...	8,400	4,400	4,400	2,000	Nw	9,800	10,000	13
AA0010	Pracownik 4 - filia 2 ...	8,400	4,800	4,300	2,000	Nw	9,800	10,000	14
AA0017	Pracownik 7 - filia 3 ...	3,600	3,100	3,100	5,000	Nw	8,700	9,000	15
AA0002	Pracownik 2 - filia 1 ...	8,600	6,200	7,700	10,000	Nw	9,700	10,000	16
AA0001	Pracownik 1 - filia 1 ...	7,500	6,100	7,700	8,000	NN	9,600	10,000	17

Source: own using the econometric analysis module in the DSS 2.0 system

The estimated linear regression model, obtained in the study, for evaluable fitter (with $R^2 = 91\%$) had form:

$$\hat{y}_t = 0{,}166\, d_1^{(t)} + 0{,}073\, d_2^{(t)} + 0{,}094\, d_3^{(t)} - 0{,}043\, d_4^{(t)} + 7{,}634 \qquad (1)$$

where $\hat{y}_t$ – the reference value ('OS' in Table 5), which *t* worker could achieve with reasonable work. Decision-makers thus receive an answer to the question: what is the current hourly rate of the employee („OZM") and what it should be ('OS')?

Based on the analysis of residuals, that is the difference between the actual value of the dependent variable and the value resulting from the theoretical model,

taking into account the standard deviation of the residuals and the critical value read from tables t-student, five main salary groups were obtained: WW –*highest*, Wn–*high*, Pw, P, Pn –*average*, Nn –*low* and NN –*the lowest* [Budziński 2001]. Among the results two extreme positions deserve further attention. In the case of an employee AA0001, who was ranked in the top leaders, it can be concluded that the rate per hour. was too low at a high level of the adopted evaluation criteria. However, AA0014 employee received an exorbitant rate per hour of work in relation to the results of analysis.

CONCLUSION

Methods integrated in the decision support system DSS 2.0 function on a common set of data, under which it is possible to carry out a coherent, logical and comprehensive analysis of the decision-making process in the selected range. In the example, the information and decision-making process involved sphere of HR and payroll. The study used two different approaches, the first related to the achievements of American school, based on a functional model (Saaty's method, simple additive weight method and WPL optimization), the second stemming from the European school, based on a relational model (ELECTRE TRI method). Results of the methods well complement each other. The resulting order of employees referred to the defined classes of preferences. In this way a picture of the structure of the ranked crew was obtained. However, the use of models and WPL optimization expands the vector criteria for inclusion in the list of required specific constraints and balances, allowing from the point of view of the employee to seek solutions that offer assurance to receive the bonus (to be in the top five highest-rated employees). Complementary to the research is to identify the level of individual wages based on an econometric model for the assessment of employees.

REFERENCES

Anderson G. C. (1993) Managing Performance Appraisal Systems, Blackwell, Oxford (UK)-Cambridge (USA), str. 13.

Armstrong M. (2005) Zarządzanie zasobami ludzkimi, Oficyna Ekonomiczna, Kraków, str. 29-30, str. 33-34.

Becker J. (2008) Architektura informatycznego systemu generowania wielokryterialnych rozwiązań decyzyjnych: (cz. 1) Koncepcja budowy modelu WPL oparta na niestandardowych zadaniach decyzyjnych, Seria IBS PAN: Badania Systemowe, Tom 64, Wyd. Instytut Badań Systemowych PAN & Polskie Towarzystwo Badań Operacyjnych i Systemowych, Warszawa.

Budziński R. (2001) Metodologiczne aspekty systemowego przetwarzania danych ekonomiczno-finansowych w przedsiębiorstwie, Monografia, Rozprawy i Studia T. (CDXLVI)372. Wydawnictwo Naukowe US w Szczecinie, Szczecin.

Encyklopedia organizacji i zarządzania (1981) PWE, Warszawa, str. 309, 310.

Król H., Ludwiczyński A. (2006) Zarządzanie zasobami ludzkimi, PWN, Warszawa, str. 60-63.

Penc J. (2007) Nowoczesne kierowanie ludźmi. Wywieranie wpływu i współdziałanie w organizacji, Difin, Warszawa, str. 18.

Pocztowski A. (2000) Analiza zasobów ludzkich w organizacjach, Wyd. Akademii Ekonomicznej w Krakowie, Kraków.

Pocztowski A. (2008) Zarządzanie zasobami ludzkimi, PWE, Warszawa, str. 36-37.

Pocztowski A. (2008) Zarządzanie zasobami ludzkimi. Strategie – procesy – metody, PWE, Warszawa, str.11, str. 224.

Przydział M. (2011) Kryteria oceny pracowników, serwis internetowy „EKONOMIA.PL", Zasoby Internetu z dnia 07.09.2011r.

http://www.ekonomia.pl/artykuly/firma/prowadzenie-firmy/kryteria-oceny-pracownikow

Roy B., Słowiński R. (2008) Handing effects of reinforced preference and counter-veto in credibility of outranking. European Journal of Operational Research, 188, s.186-187.

Saaty T.L. (1980) The analytic hierarchy process: Planning, priority setting, resource allocation, McGraw-Hill International Book Co., New York.

Szałkowski A. (red.) (2000) Wprowadzenie do zarządzania personelem, Wyd. Akademii Ekonomicznej w Krakowie, Kraków, str. 64.