

Multivariate Statistical Analysis Approach in Modeling the Job Related Satisfaction

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Abstract. The main purpose of the study is to analyse and to model the perception of job related satisfaction. The survey of employee satisfaction was conducted to gain an understanding of employee's needs, opinions, concerns, skills, and perception of the organization. Paper shows the application of the cluster analysis framework for the employee classification in the organization. The classification into three clusters was chosen. The k-means method has been used for classification. According to the procedure proposed by Carmone, Kara, and Maxwell ([Carmone *et al.*, 1999]) – in the first step, 20 variables were used as a base for classification (selected out of complete list of 79 statements). The motivation for those analyses was to improve the quality of human resources management and to diversify the managerial approach towards distinctive groups of employees.

Keywords: Classification, Human Resources Management, Job Related Satisfaction.

1 Introduction

The main purpose of the study is to analyse and to model the perception of job related satisfaction. The level of employee satisfaction determines work quality, loyalty, engagement and identification with company objectives. The survey of employee satisfaction was conducted to gain an understanding of employee's needs, opinions, concerns, skills, and perception of the organization. The motivation for those analyses was to improve the quality of human resources management and to diversify the managerial approach towards distinctive groups of employees.

Analyses covered key areas of HR management – motivation and communication, evaluation of working conditions and working climate, measurement of attitudes and opinions. Data collected with the use of various measurements scales were analysed with the multivariate statistical techniques. Additionally, the classification of employees has been done.

Job related satisfaction is defined as positive attitude of employee towards the company, duties and co-workers (see [Levy Garboua and MontMarquette, 2001], and [Freeman, 1978]). The level of the perception of job related satisfaction is strongly related with the difference between subjective evaluation of the existing situation and the expectations. Employee's satisfaction level

does not always reflect real situation, more often is determined by working conditions perception. It is assumed, that highly satisfied employee works harder, more efficiently, and with less slack and waste than unhappy person. He (she) is also more innovative and entrepreneurial, having the interest of the company at heart, given that they see their own satisfaction intimately and directly tied to the success of the company. Furthermore, it is often assumed that employees' satisfaction has a direct, positive impact on functioning of whole organization. It cannot be denied, that ineffective human resources management very often causes lack of job related satisfaction. It can be result of bad compensations system, unfair motivation system, ineffective internal communication or bad working climate [Armstrong, 1996]. Thus, those areas should be constantly monitored.

Companies, in order to measure satisfaction level, often conduct a questionnaire survey. Employees' opinion survey became an essential component of organizational culture and provides a picture of organizations' need for managerial improvements. These surveys can be used to solicit employee opinion on a variety of issues such as the company's success in communicating its mission to employees, or local issues such as quality of the working environment. A survey makes it possible to gather responses from individuals who would otherwise surely be hesitant to speak out their opinions and suggestions.

The findings and recommendations from the employee satisfaction survey enable human resources department to make essential improvements. Furthermore, identification of strengths and weaknesses is possible. Additionally, monitoring of job related satisfaction and identifying areas that need improvement could result in retaining highly performing staff members. Appropriate recommendations can help in eliminating of existing and potential problems and threats. Moreover, the results of feedback process provide an understanding how the employee perceives the organization along different dimensions. The role of the feedback can be summarized as follow:

- Is essential in facilitating development and organizational change.
- Allows the organization to focus on needs and leverage its strengths.
- Informs the organization management on which actions could create problems for the employees.
- Provides management with employees' feedback (both positive and negative) on the internal health of the organization.
- Measures the impact of current programs, policies and procedures.
- Can be used to motivate employees and improve job satisfaction.

Summing up, an employee satisfaction survey is essential source of information about organization and enables recognition of the perception of the job related satisfaction and employee happiness (in terms of every aspect in the organization). Moreover, it gives the opportunity to identify most motivating and de-motivating factors.

2 Surveyed Organization

The analysed company, a branch of multinational group is one of the biggest manufacturers of chassis systems on local market. Its products are sold to car manufactures, such as Fiat, Ford and General Motors. In view of long tradition and specific production profile, the company put special emphasis on the quality, thus plant has ISO/TS 16949 and ISO 14001 quality certificates.

The plant has long tradition, but in the recent period several times has been taken over by various multinational corporations. Hence, the organization culture has been destabilized. Consequently, whole organization suffers declining morale and motivation among employees. As a side effect, the perception of job related satisfaction also declined. To tackle the negative symptoms observed in the company, the least effective areas in the organisation had to be identified. Therefore an employee satisfaction survey was conducted.

3 Survey Questionnaire

The survey measures facets of the organization that employees feel satisfied with, those which are viewed less favourably, and opportunities for improvement. Hence, the survey questionnaire included items on the following areas:

- Motivation system.
- Internal communication and relation with superior.
- Job climate.
- Attitude to the company and duties.

To identify specific groups of employees, 568 people were surveyed. Over 216 responses were collected. This amounts to approximately 38% of employees. Relatively high percentage of persons working in supportive production took part in the survey, at the same time direct production employees participated the least. Furthermore, comparatively many young employees (26 to 32 years old) working between 2 and 5 years partake in survey. On the other hand, employees with job seniority above 16 years and older than 47 years old, did not respond in large numbers. Usually, this kind of survey is carried out with use of questionnaires, interviews and simply by observations. A questionnaire used for this employee opinion survey contained items that were rated on a five-point scale. Respondents were asked to choose category which best corresponds to their attitudes on a five point Likert scale: 1 – Strongly disagree, 2 – Disagree, 3 – No opinion, 4 – Agree, 5 – Strongly agree.

These items have been developed to measure different dimensions of the organization – communication, motivation, job climate and leadership.

Table 1. The survey's questions concern four major issues, which have strong effect on job satisfaction in organization. In order to find those factors, the survey covered major issues, which presumably have negative influence on the level of satisfaction perception.

Employment category	Current employment		Surveyed employees	
	Number of employees	Rate	Number of employees	Rate
1. Direct production	392	69%	123	57%
2. Indirect production	86	15%	64	30%
3. Administration	90	16%	29	13%
Job seniority				
1. Up to 1 year	132	23%	41	19%
2. Between 2 and 5 years	73	13%	62	29%
3. Between 6 and 10 years	12	2%	6	3%
4. Between 11 and 15 years	26	5%	6	3%
5. Between 16 and 20 years	77	14%	21	10%
6. Longer than 21 years	248	44%	80	37%
Sex				
Female	103	18%	46	21%
Male	465	82%	170	79%
Age				
1. Up to 25 years old	90	16%	43	20%
2. Between 26 and 32 years old	108	19%	59	27%
3. Between 33 and 39 years old	60	11%	23	11%
4. Between 40 and 46 years old	130	23%	45	21%
5. Between 47 and 53 years old	147	26%	41	19%
6. Older than 54 years	33	6%	5	2%
Position				
1. Managerial	40	7%	17	8%
2. Blue-collar	528	93%	199	92%
Type of employment contract				
1. Contracted worker	478	84%	178	82%
2. Temporary worker	90	16%	38	18%
Total	568		216	

4 Classification of Employees

In the analysis it was highly important to identify, if there are groups of similar employees and to distinguish differences between those identified groups. As the criterion for clustering, the descriptive variables (questionnaire statements), that expressed employees' opinion about issues important for the company were used. In accordance with the character of the variables, the k-means technique was chosen for clustering. An extensive discussion on

classification techniques may be found in several works dealing with k -means clustering algorithm (see [Gatnar and Walesiak, 2004], [Gordon, 1999], [Walesiak, 1996])

Although it limits the usefulness of the survey and the analysis and additionally limits the possibility of knowledge discovery – because of the explicitly expressed managerial needs formulated by the Human Resources Department, the classification into three clusters has been chosen. In the survey there were 79 variables. Not all were used for the analysis. The variables selection was based on the Heuristic Identification of Noisy Variables (HINoV) algorithm which uses Hubert and Arabie's ([Hubert and Arabie, 1985]) adjusted Rand index and k -means method of classification. Carmone, Cara, and Maxwell (1999, p. 507) demonstrate that using HINoV the results with simulated data helps identify noisy variables. Clustering objects based on only the non-noisy variables give better cluster recovery. The HINoV algorithm contains the following steps:

1. The starting point is data matrix for the analyzed objects $A = \{A_1, \dots, A_n\}$ and for set of descriptive variables $M = \{M_1, \dots, M_m\}$.
2. For each variable j the k -means clustering is performed. The arbitral (required) number of clusters is requested.
3. Hubert and Arabie's adjusted Rand indices R_{jl} ($j, l = 1, \dots, m$) for all $j \neq l$ are calculated. Since R_{jl} are symmetric – $m(m-1)/2$ values are to be calculated.
4. The $(m \times m)$ matrix of adjusted Rand indices R_{jl} ($j, l = 1, \dots, m$) is constructed. Each row (or column) is summed up $R_{j\bullet} = \sum_{l=1}^m R_{jl}$.
5. The measures (sums) $R_{1\bullet}, R_{2\bullet}, \dots, R_{m\bullet}$ are ranked. By analyzing scree diagram (looking for a kink point) – the subset of h variables with highest contribution to the cluster structure is selected. The value of the $R_{j\bullet}$ indicate the contribution of that variable to the cluster structure. Relatively low values of $R_{j\bullet}$ indicate noisy variables – those $(m-h)$ variables with insignificant contribution to the cluster structure are eliminated from the further analysis.
6. Rerun the k -means clustering of the set of analyzed objects $A = \{A_1, \dots, A_n\}$ using only h selected variables.

As a result of the HINoV algorithm application, out of the complete list of 79 statements (variables), a sub-set of twenty variables was selected for cluster analysis.

Resulting classification of employees into three groups gave classes with 68, 85 and 63 respondents respectively. Third class, the smallest contains employees with somehow ambivalent opinions. One may notice that there is slight under-representation of men (of -5,1%). Employees working in the administration (white-collar) are overrepresented (14,9%). When job seniority is considered, there is substantial under-representation of employees work-

ing 11–15, and 16–20 years (–33,3% and –19,0% respectively). It receives reflection in the age of the class members.

Very interesting is the character of the class number one and two, which might be labeled *satisfied* and *dissatisfied*. In the class number one (*satisfied*) – the mean value in as many as 17 statements (out of twenty), reaches maximal value. In contrast – all 20 variables has minimal average value in the class number two (*dissatisfied*). The class, which is called *satisfied* has the structure very similar to the structure of the whole sample with respect to three characteristics – *employment category*, *position* and *sex*. There is substantial overrepresentation (46,7%) of the oldest employees in this class. When job seniority is considered, there is substantial overrepresentation of employees working less than one year, 11–15, and 16–20 years (22,8%, 16,7% and 9,5% respectively). Unexpectedly there is overrepresentation (of 8,8%) of temporary employees in this class. The class, which is called *dissatisfied* has the structure considerably different from the structure of the whole sample. There is substantial overrepresentation of *direct* and *supportive production* workers (8,1% and 8,9%) in this class. Thus the male employees are overrepresented by 7,3%.

5 Summary and Managerial Recommendations

The multivariate analysis and clustering of employees proved that there is clear distinction into at least three categories of employees. There is interesting impact resulting from the analysis for decision makers in the Enterprise. The most important is the information that there is need for HR policy differentiation. From the HR management point of view – the *satisfied* people do not require as much attention as those *dissatisfied*. Therefore it is clear that employees belonging to the class number two (*dissatisfied*) need special consideration. In order to formulate managerial recommendation – the analysis of the class number two (*dissatisfied*) is necessary. The lowest mean values may be observed for statements 18, 13, 20, 19 (mean values: 1,26; 1,45; 1,56; 1,64 respectively). The statements analysis shows that the most troublesome issues are connected with compensation and motivation system. This conclusion may be strengthened by the fact, that also in the class number one (*satisfied*) respective mean values are also low (although the highest in three classes). The corresponding values are: 2,96; 3,29; 3,19; and 3,51. Mean values in this class for other statements reach up to 4,71 (statement 17), 4,54 (statement 8).

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Table 2. Characteristics of the clusters

	SPECIFICATION	CLASS		
		I	II	III
	Number of employees in each class	68	85	63
	STATEMENTS	MEANS		
1	Internal communication in company is functioning properly	3,69	2,60	2,68
2	I am always properly informed on results of my job evaluation	3,72	2,13	2,65
3	There is no exaggeration in assessing my behaviour	3,31	2,42	3,24
4	I could honestly recommend my company to my acquaintances as a good place to work	4,18	2,29	3,22
5	I am aware on my company condition and its future plans	3,65	2,15	3,78
6	My boss appreciates when I work well	3,84	2,08	2,48
7	In the company creative and energetic people are being promoted	3,94	1,85	3,24
8	I care for my company image	4,54	3,65	4,00
9	I am informed on objectives and tasks planed for my department for this year	4,01	2,52	3,29
10	I have never experienced not ethical behaviour	3,56	2,38	3,94
11	I consider my employment secure and stable	3,81	1,91	3,16
12	Our company cares for employees	3,90	1,76	2,40
13	I receive fair compensation for my efforts	3,29	1,45	1,97
14	In our department there is no unfair rivalry between co-workers	3,75	2,86	3,84
15	In case of difficulties I can surely count on my co-workers help	4,49	4,09	4,44
16	When I seek information for my work, I know where I can find it	4,43	3,24	3,90
17	I know what is expected from me on my workplace	4,71	4,15	4,32
18	In my company employees are compensated according to their achievements	2,96	1,26	2,11
19	I clearly understand compensation policy	3,51	1,64	2,10
20	The compensation system stimulates employees involvement and efficiency	3,19	1,56	1,87

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