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The measurement of employee motivation by using multi-factor statistical analysis

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Abstract

The proposal and implementation of an effective motivation program is one of the key management tasks of a company. Improperly designed and applied motivation programs can have a negative impact on employees, who are not motivated to achieve maximum performance. The paper will also deal with the problems of employee motivation and the motivation programs in a selected industrial company. The motivation structure analysis will be based on the general knowledge of the theory of motivation, together with the analysis of the employees' motivation profiles. The fundamental tool used in this process is a cluster analysis and its usage in the creation of motivation programs. The analysis of motivation factors and their order will be made according to the level of importance they have for the employees, which will be assessed by the Questionnaire Method. The Cluster Analysis will be used due to the possibility of creating various types of motivation programs. The result will be a proposal for the creation of methodological unified motivation programs by using multi-factor statistical analysis (cluster analysis). On the basis of the results obtained from our analysis, we will be able to determine if it is possible to develop a unified motivation program for employees within a selected industrial company.

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1. Introduction

All activities of a firm are realized through the performance of its employees. The realization of every kind of strategy requires the involvement of employees of a particular structure (a number of employees, their professional and qualified structure) and particular quality (abilities, knowledge, skills), their willingness to the particular kind of performance, which is actually based on the motivation level as well as on the approach of employees to their firm. The determination of these needs, the solution of sources for their satisfaction (the motivation of employees and formation of their "quality") is the basic principle of the personal strategy in a firm, wherein the motivation programme of a firm should form an inseparable part (Hitka, 2009).

As Devadass (2011) states scholars and practitioners care about cultivating, increasing, and maintaining work (employee) motivation. Motivation research has a long history of considering employee motives and needs (Alderfer, 1969; Maslow, 1954; McClelland, 1961). Interest in these areas peaked in the 1970s and early 1980s, and the last fifteen years has seen little empirical or theoretical research. According to Moorhead & Griffin (1998) is employee performance frequently described as a joint function of ability and motivation, and one of the primary

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tasks facing a manager is motivating employees to perform to the best of their ability. Pinder (1998) cited in Devadass (2011), describes work motivation as the set of internal and external forces that initiate work related behaviour, and determine its form, direction, intensity, and duration. Work motivation is a middle range concept that deals only with events and phenomena related to people in a work context. The definition recognizes the influence of both environmental forces (e.g., organizational reward systems, the nature of the work being performed) and forces inherent in the person (e.g., individual needs and motives) on work-related behaviour. An essential feature of the definition is that it views work motivation as an invisible, internal, hypothetical construct (Devadass, 2011).

Motivation, delegation of powers gets its importance at the present time as well. Authors Foot & Hook (2005), Armstrong (2002) cited in Gabčanová (2011), unanimously agree upon the fact that the management of the performance is the process by which the performance of the organization, team and individual improve and is used by the leaders for managing. Hall (2008) clearly declares, “the very best way for managers to improve employee performance is to set clear expectations and hold regular business reviews to those expectations” (p. 194). The scientists try to discover the dependence between working performance and motivation. However, the answer is not unequivocal in all cases (Gabčanová, 2011).

2. Research objectives and used methodology

The need of an employee motivation program was solved for a number of Czech and Slovakian industrial manufacturing enterprises. The paper shows the results of their application on a selection of furniture-making enterprises in the category of shop-floor workers. This company uses the following motivation factors: payments and allowances, education of employees and other advantages. According to motivation criteria used in the company it is necessary to detect the following questions for the current system of workers motivation improvement:

- To analyse the current condition in motivation of workers,
- To find other motivation factors that highly influences worker performance and also verifying if there are exceptions to the primary motivation factors (measured or estimated) also so called latent motivation factors (hidden, immeasurable) acting in the background of primary motivation factors,
- To check the possibility of creating unification motivation program for workers with the intention of its effective application in the practice.

Analysis of motivation structure accepts general knowledge from the theory of motivation. Together with analysis of employees' motivation profile it allows us to obtain information about strong and weak aspects of managerial systems within organizations and its motivation impacts. Without those basic knowledge suggestions are only stochastic processes, which will miss the goal when they do not correspond to employees' priorities. The most important criteria for employee performance are those which cause that employees feel that they do a work which has a sense, which is important for an employer, interesting for employees and which give to employees ability of their personal development. But there are also other factors which impact employees' performance-career growth, adequate financial reward, suitable working environment and interpersonal relationships and last but not least respect of personal honour.

Before analysis of motivation structure it would be understood and evaluated all events, which have a big impact on company function, on workers willingness to work and on workers performance. Therefore it is necessary to get information about:

- Technical and organizational conditions of work,
- Socially-demographic and qualification features of employees,
- Information about features of job environment, about job conditions and about social equipment of job places,
- Applied systems of evaluation and rewarding,
- Application of personal management system and own personal work in a company,
- Application of social welfare system and employees advantages in a company,

- Collecting and analysis of so called soft data (information about satisfaction or dissatisfaction of a worker, about their value orientation, aspirations, relation to work, relation to superiors, to fellows and to whole company).

After analysis of presented social-economic information it can be created outstanding motivation program for employees. These issues are the subject of the works by authors, for instance, Hitka & Rajnoha (2003) and Zámečník (2007).

These authors have elaborated and applied a methodology for the analysis of employee satisfaction and for motivational factors for the employees of industrial manufacturing enterprises through the assistance of multi-criteria statistical analysis methods – i.e. cluster analyses. A partial task of this methodology is the creation of a universal, easily modifiable questionnaire that is usable for all employee categories and which determines the valuation spread used to evaluate responses to the questionnaire. On the basis of practical verification with the assistance of cluster analysis, groups are formed of similarly motivationally oriented employees. Analysis of these groups is further determined by the priority allocated a motivational factor for an individual group. The motivational factor can subsequently be used in the creation of a motivational programme for a group of similarly motivated employees.

Cluster analyses are one of the possibilities available to exploit the information contained in multi-dimensional comparisons using the differentiation of sets into several relatively unified sets of clusters. The application of the cluster analysis method leads to favourable results – especially there where the set under investigation in reality falls into classes, and where objects have a tendency to gather together into natural clusters. Through use of appropriate algorithms, the structure of the set under investigation can be peeled away to reveal its consistent components and thus to classify the individual objects. This can be achieved through the radical reduction of the dimensions of roles – and this in such a way that a number of variables will be represented by one variable expressing its association or belonging to such a defined class or type. The aim being to achieve in essence such a state where, the objects to be found within a cluster will as similar to one another as possible and the objects in various clusters will bear as little similarity to one another as is possible. In view of the fact that employee motivational systems are based on differing criteria according to variable characteristics, it is appropriate to use cluster analysis – further only CLUA, for the final evaluation of motivational factors, where through the use of a suitable algorithm, we can work our way to an evaluation of the realistic order of motivational criteria. Application of the CLUA system is performed in three stages: differentiation – the selection of groups, their interpretation – naming of these groups and their “profiling” – and the description of the characteristics of each of these groups. Cluster analyses can therefore be used for research investigations into the possibility of creating certain types of motivational programmes, that is to say, the possibility of establishing a unified motivational programme for a group of workers with similar motivational profiles. The aim of analysis, is to discover on the basis of the measurement of the similarity of respondents’ answers to questionnaires, whether or not it is possible to identify a group of employees with a similar make up of motivators among the employees – for whom it would be possible to elaborate (tailor-made) unified motivational programmes with the intention of simplifying and rendering more effective the validation in practice of motivational programmes in everyday practice. Apart from the aforementioned, cluster analysis can also be used for more detailed verification of the structures and ranking of the importance of motivational criteria. From among the wide range of cluster analysis methods available, we chose the Hierarchical Clustering Method – i.e. the so-called Ward Method with its measurement of the scale or degree of similarity in the responses of individual respondents in the simplest possible way, i.e. through the use of the so-called Euclidian Distances Method.

The actual phases in the preparation, creation, and realisation/implementation of the motivational programme can be broken down into the following basic steps. (Fig. 1):

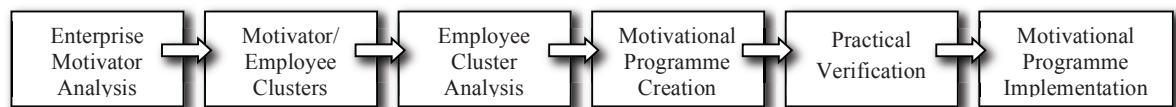


Figure 1. Schema of the creation of motivational programmes using the cluster analysis

3. Results and discussion

As already mentioned above, this methodology was applied in a number of Czech and Slovakian industrial manufacturing enterprises. In order to foster a better understanding, the contribution shows the results of their application on a selection of furniture-making enterprises in the category of shop-floor workers. Information regarding motivation in these enterprises was acquired by means of questionnaires containing 27 motivational factors. Out of the 100 respondents, 66 shop-floor workers filled-in the questionnaires. From the statistical significance point-of-view, this is a sufficient number for the determination of motivator cluster structures and cluster analysis of the motivational criteria of the shop-floor workers of this enterprise. The respondents had the task of indicating the motivational factors and assigning them an evaluation ranging from 5 to 1 (5 – Most significant; 4 – Very significant; 3 – Significant; 2 – Quite insignificant; 1 – Insignificant).

Table 1 (shown below) illustrates the rankings of the individual motivational factors. From the results of the analysis, it is clear that – surprisingly, among the most important motivators in the enterprises investigated were - self-sufficiency (i.e. independence) when working, free time, interpersonal relationships within the workplace, degree of personal responsibility and atmosphere in the workplace. It is only in eighth place of importance that wage/salary levels are to be found, and which – in parallel research into comparable enterprises (as well as in earlier research studies conducted within these same enterprises) this was to be found in the priority position at the peak of the motivator rankings. This is proof of the need of employees for improvements in the interpersonal and working relationships in employment, and which suppress the primary desire for a higher income. Answers on questions from the survey give information of ordinal qualitative variables. From the methodology point of view it is classic multidimensional matrix: objects (workers) x attributes (motivation factors).

Table 1. Motivator rankings in selected enterprise

Ranking:	Motivator:	Sum of responses
1	Self-sufficiency (Independence) when working	264
2	Free time	251
3	Interpersonal relationships within the workplace	241
4	High degree of personal responsibility	239
5	The atmosphere in the workplace	234
6	Job security	230
7	Interesting work	229
8	Wages/salary levels	226
9	Way work instructions are delivered	224
10	The quality of the inputs needed to work well	222
11	Working hours, overtime	221
12	The company's "name"	219
13	Independence	205
14	The enterprise's ecology	204
15	Sufficient space to work in, in the workplace	201
16	The relationship between the management and employees	200
17	The organisation of work	198
18	The working environment	197
19	Financial bonuses and benefits	196
20	Noise, dust, heating and lighting conditions at work	193
21	Recognition, rewards, praise by superiors	192
22	Validation through use of one's qualifications	185
23	Ways decisions are made	185
24	Social services	180
25	Career growth possibilities/opportunities	166
26	Information flows	163
27	Education and personal growth	157

The following Figure 2 shows the motivational structure criteria for labourers in selected enterprises hierarchical cluster – the tree-diagram depicts the cluster analyses of 27 mutually dependent motivational factors. These clusters of mutually-interdependent motivators was created through use of the principles of the hierarchical agglomeration procedure, which is founded on the progressive clustering of groups of elements – starting with the most similar, and, in the following steps – mutually less similar clusters.

The first motivator cluster is how interesting the work is, self-sufficiency/independence when working, a high degree of personal responsibility, and free time. This group of criteria can be complexly called the work result recognition group. The second motivator cluster is made up of motivators like validation through the use of one's qualifications, the sufficiency of room to work freely in the workplace, the working hours, independence, and the possibility of education and personal growth. It is possible to see the effort by co-workers to find self-realisation and to develop their own personalities. The third cluster is composed of the working environment and noise, dust, and heating and lighting conditions. Behind the above-mentioned motivators, can be seen the interest by the workers in suitable ergonomic conditions in the workplace. To a wider extent, the third cluster is linked to cluster No. 2.

The fourth cluster is made up of the motivators – job security, wage/salary levels and financial benefits and bonuses. This cluster can be called the materialistic cluster. In its background can be felt the material needs of the workers and their efforts to secure the same.

The fifth cluster is composed of the motivators – the possibility of career growth, social services, information flows, decision-making methods, and the relationship between the enterprise's management and its employees. This cluster can be called the organisational– career cluster. The sixth cluster is that of motivators like the “name” of the enterprise, the quality of inputs needed for good work, and the ways in which decisions are made. This goes together with the seventh cluster - made up of motivators like the ecology of the enterprise, the organisation of work, recognition, rewards and remuneration and praise by superiors, atmosphere in the workplace and interpersonal relationships. This cluster can be called the collaboration and cooperation cluster.

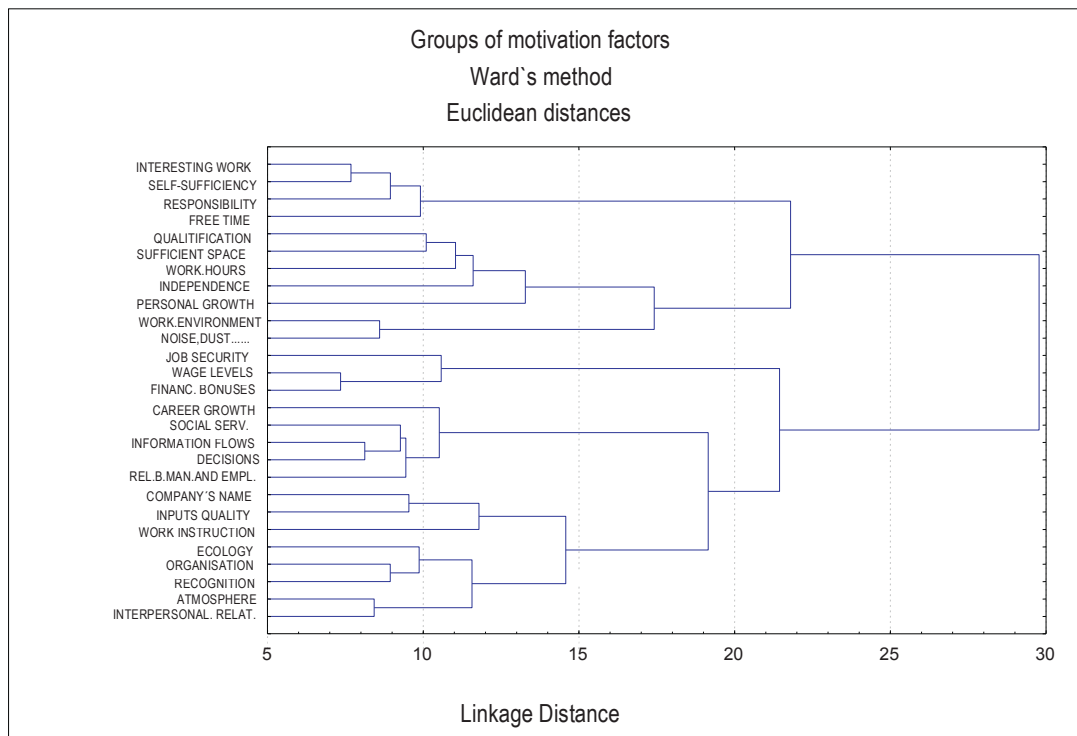


Figure 2. Hierarchical cluster analysis of the structure of motivational criteria for labourers

Similarly, it is also possible to depict the structure of the similarities between the individual profiles of the workers in the selected furniture-making enterprises, and subsequently – to identify groups of workers with similar motivational structures. Interpretation of the identified groups by means of more detailed breakdowns of the

individual motivational factors is a further task in the course of analysing the make-up and creation of motivational programmes for workers of industrial manufacturing enterprises. The problems associated with employee motivation in the analysed furniture-making enterprises were also conducted to meet the needs of the middle management. More detailed results related to both issues can be found for instance in the works by Zámečník (2009) or Hitka (2009).

Marking the motivators in the questionnaire provides information as to the character of ordinal qualitative features. From the methodological perspective, this has to do with a classical multi-dimensional matrix of the Objects \times Tracked Features type useable in the course of upholding certain basic principles for the validation and application of multi-dimensional statistical methods. Of these methods, in this analysis, we used the Cluster Analysis Method due to the need to investigate the possibilities of creating certain types of motivational programmes – that is to say, the possibility of establishing a unified motivational programme for a group of employees with similar motivational profiles (not only for blue-collar workers, but also for middle management too).

The aim of the analysis was to discover whether or not – and on the basis of the measurement of similarities between the responses by workers to the main questionnaire, there existed the possibility of identifying groups with similar compositions of motivators for whom it would be possible to elaborate a unified motivational programme with an orientation on its simplification and on making it effective to validate such a motivational programme through implementation in everyday working practice. Apart from this, the Cluster Analysis Method was also used for a more detailed verification of the structures and rankings by importance of motivational criteria.

Out of the great quantity of potential cluster analysis techniques, we selected the “Hierarchical (Tree) Clustering Method” – the so-called “Ward Method” and for more detailed analysis purposes, we chose the method with an orientation on the measurement of degrees of similarity in the responses of individual respondents in the simplest way possible, through the so-called “Euclidian Distances” Method. The whole overall approach was chosen in such a way as to be suitable for qualitative, non-metric quanta (i.e. motivational factors) set out in a unified scale (Degree of importance: 1 – 5; eventually: 1 – 9).

4. Conclusion

The design and implementation of an effective and economically effective motivational programme should be one of the key roles of each and every enterprise. An incorrectly and poorly applicable motivational programme has a negative influence on the employees and simply does not motivate them to strive for maximum performance. At the current time, the motivation of the majority of employees in the majority of industrial manufacturing enterprises fails to meet all of the needs and requirements of those employees.

On the basis of analysis and of the acquired results, it can be stated that - in the enterprises we analysed, there exists the possibility of creating motivational programmes for groups of similarly motivationally-oriented employees unified according to their motivational and value-orientations. At the same time, it is necessary to point out that the suggested possibility for the unification of motivational programmes for groups of employees of necessity must undergo even more detailed practical elaboration and subsequent verification. At the same time, there is a need to emphasise the interim and on going need for the updating of motivational programmes in the context of developments in employees' values orientations, which may change through time. Further, there exists the possibility for the eventual individualisation of generalised motivational programmes through the use of motivators associated with self-realisation and individual employees' personal ambitions.

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