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# Establishment of motivation programs for workers in manufacturing companies using cluster analysis

## Uspostavljanje poticajnog programa za radnike u proizvodnim tvrtkama primjenom klusterske analize

Pregledni rad • Review paper

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**ABSTRACT** • The paper analyses the possibilities of establishing motivation programs for workers in a selected company. The motivation factors and values that affect the quality of a worker's performance are systematically explored. The paper also addresses the problems of the "delayed", non-measurable motivation factors, which act in the background of the primary motivation factors, i.e. direct measurable motivation factors. Finally, the paper presents the possibility of establishing a unified motivation program for individual worker categories based on the results of the ongoing cluster analysis.

**Key words:** motivation, motivation of workers, analysis of motivation factors, motivation program

**SAŽETAK** • U članku se analiziraju mogućnosti ustanovljivanja poticajnih programa za radnike u odabranom poduzeću. Sustavno su istraživani poticajni činitelji i vrijednosti koje utječu na kvalitetu uposlenikovih rezultata. Članak također prikazuje rješavanje problema tzv. zakašnjelih, nemjerljivih poticajnih čimbenika koji djeluju u pozadini primarnih odnosno izravno mjerljivih poticajnih čimbenika. Naposljetku, prikazane su mogućnosti ustanovljivanja unificiranih poticajnih programa za pojedine skupine uposlenika prema ponavljajućoj klusterskoj analizi.

**Ključne riječi:** poticaj, poticaj radnika, analiza poticajnih čimbenika, poticajni program

### 1 INTRODUCTION

#### 1 UVOD

Personal management and its application in human management is an inevitable part of management in every modern company. As every company consists of human resources, the main goal of personal management is the establishment of conditions for effective fulfilment of business concept based on employees' performance. Actually, many companies

underestimate motivation as something generally provided and unnecessary in practice (Bulák, 1980). At the same time managers do not respect the essence of motivation and they also ignore the effective application of motivation. However, motivation and rewarding are considered as the most important tasks in regulating the employees' behaviour. Targeted development of rules and conditions, affecting people in their job performance, proved to be a significant asset for the company, by way of improving work effectiveness.

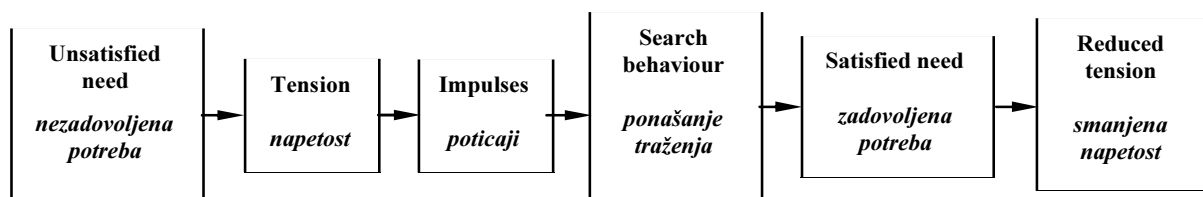
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Understanding the principles of job motivation enables managers to assume and change their behaviour as well as the behaviour of their co-workers.

## 2 PROBLEM ANALYSIS 2 ANALIZA PROBLEMA

Motivation is a specific exterior behaviour. It can also be defined as the readiness for doing something, under conditions in which a particular need of an individual will be satisfied when performing an action. These are the physiological and psychological shortcomings that make certain results attractive. This process of motivation is presented in Figure 1 (Robbins, 1995).



Slika 1. Basic motivation process (Robbins, 1995)

Figure 1 Temeljni poticajni procesi (Robbins, 1995)

Motivated workers are in a state of tension. In order to reduce the tension, they start different activities. The higher the tension, the bigger the activity is necessary to reduce it. Accordingly, when a worker carries out diligently an activity, it can be concluded that he is driven by the desire to achieve the goal he considers worth the while.

Fifty years ago, the concepts of motivation started to be developed. The following were the ideas that appeared first (Robbins, 1995):

*Theory X and Theory Y.* Douglas McGregor suggested two separate theories on human being: one was basically negative, marked as Theory X, while the second was basically positive, and was marked as Theory Y. After studying the way by which managers treated their workers, he concluded that the manager observed a human being according to certain groups of assumptions, and that he tried to adjust his behaviour toward his subordinates according to these assumptions.

*Theory of "Motivation hygiene".* This theory was suggested by the psychologist Frederick Herzberg. He believed that the relation of an individual to his work was fundamental, and that his attitude toward his work might easily determine both his success and his failure. He required from people to thoroughly describe the situations in which they felt exceptionally good or bad in relation to their work.

*The theory of three needs.* David McClelland and others thought that there were three main relevant motives, or needs at work: 1. the need for achievement - the impulse to be distinguished, to make achievements in relation to a group of standards, the desire to succeed; 2. The need for power - the need to make others behave in the way they otherwise would not; 3. The need to belong - the desire for friendly and close relations with other people.

*The theory of setting goals.* There are many positive research results that confirm the theory according to which the intentions expressed as goals may be a strong source of work motivation. It can be said with a considerable degree of certainty that specific targets lead to an increased effect, and that hard targets, when accepted, result in better effects than easy targets.

*The theory of back up.* This theory neglects the inner state of an individual, and only focuses on what a person goes through when carrying out an activity. Since it is not focused on what initiates the behaviour, this is not a theory of motivation. However, it provides a powerful means of analysing the ways for controlling behaviour, and therefore it is considered in the discussions on motivation.

*The theory of non-partiality.* It says that the workers notice what they get from a work situation (result), compared to what they invest (input). They determine their "input - output" ratio with the "input - output" ratio of the relevant co-workers. If they notice that their ratio is the same as the ones of the relevant co-workers they compare themselves with, then we have the situation of non-partiality. If the ratios are different, we deal with partiality. When inequality happens, workers will try to correct it.

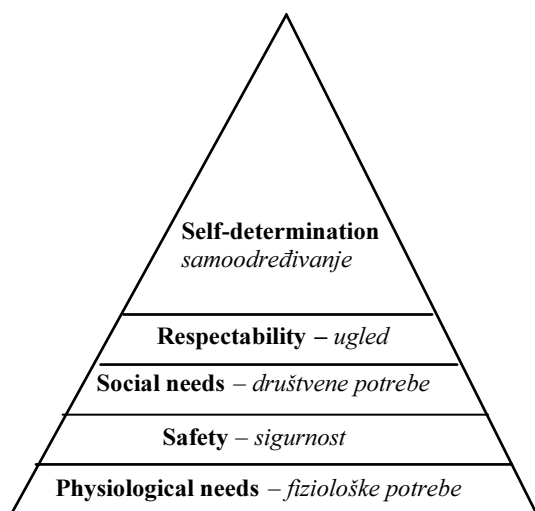
*The theory of expectance.* The most complete explanation of motivation is offered by the theory of expectance. Although it has also been criticised, scientists largely speak in favour of this theory. The theory of expectance essentially confirms that the power of trying to achieve something somehow depends on the power of hoping that the work will end in a result, a result that is interesting for the individual. Consequently, the theory includes three variables:

1. Attractiveness - the significance given by an individual to a possible outcome or award obtainable at a job. Unsatisfied needs of the individual are also considered.
2. Association of the work effect with the award - the degree in which an individual believes that a certain work effect level will lead him to the desired result.
3. Association of the commitment with the result - a probability by which an individual has foreseen that the given amount of commitment will lead him to the work effect.

The most renowned motivation theory is the Abraham Maslow's hierarchy of needs (Robbins, 1995). It is based on the hypothesis that within every human being there is a hierarchy of the following necessities:

1. Physiological needs - the ones that include hunger, thirst, shelter, sex, and other needs of the body;
2. Safety - includes the need for safeness and protection from physical and emotional injury;
3. Social needs - includes the inclinations and the need to belong, acceptance and friendship;
4. Respect - to be respected is an impulse to become what we are capable of; includes growth, achievement of our own potentials and self-fulfilment.

After one of these needs has been completely fulfilled, the following one becomes dominant. Figure 2 shows how an individual climbs from the bottom



**Slika 2.** Maslow's hierarchy of needs (Robbins, 1995)  
**Figure 2** Maslowljeva hijerarhija potreba (Robbins, 1995)

towards the top of the hierarchy. Although none of the needs is ever entirely fulfilled, the one that has mostly been satisfied does not present motivation any more.

There is no simple and all-encompassing group of guidelines. The basics of what we know about motivating workers in firms are summarised in the following instructions (Robbins, 1995):

- Try to recognise single differences;
- Relate people to the jobs;
- Use the goals;
- Make efforts to regard the goals achievable;
- Individualise awards;
- Associate the awards with the work effect;
- Check the impartiality of the system;
- Do not underestimate money.

People can be motivated by anything that mobilises them into an activity and shows them a direction and an activity goal, meaning needs, values, ideas, goals which are perceived by a human being. Motive is a factor that increases intensity of performance and behaviour to everyone, and it is also a factor that shows direction or content of behaviour aimed at reaching the goal. Everybody can ask themselves, why they did this or that and everybody think about reasons of their own behaviour. Everything that leads human activity is called activity factor or activity resources.

Activity motivation is made of activity resources or factors that are felt to be incentives or motives.

All companies think about steps to be taken for reaching a permanently high human performance (Sujová, 2002). It means that higher attention should be focused on the most suitable ways of human motivation by tools such as various stimuli, allowances, staffing, praises, promotions, etc. The goal is to create motivation processes and working atmosphere which can help in reaching performances that would satisfy the managers. Motivation is a complex of specific inner conditions, which lead human beings to some activity and keep this activity going at some level. At the same time, this activity should be oriented to a specific goal.

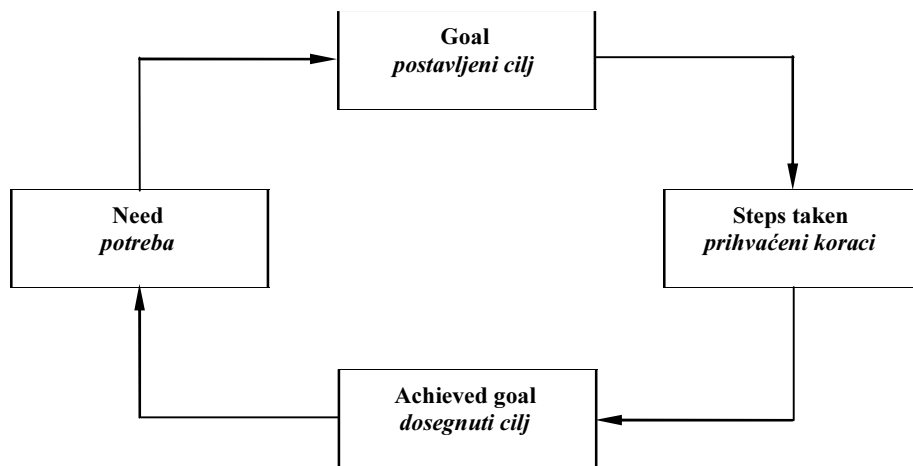
The most important motivation factors are needs, environment and character of a person. Motivation is one of the most important managerial activities connected with the activity of a human being and his character (Zámečník, 2000). Each meaningful activity of a human being can be considered as motivated activity. The base of a motivation process consists in unsatisfied need. The lack of something is the first step leading a person to the behaviour oriented to a goal. When the goal is reached, the need is satisfied and the process of motivation is performed.

The process of motivation can be presented as a closed cycle (Figure 3) related to needs and the concept that motivation is initiated by a mind process or by a spontaneous awareness of unsatisfied needs. These needs create desires to achieve something or to get something. After setting the goals that would satisfy the needs, tasks should be set which are expected to lead to reaching the goals. When the goal is reached, the need is satisfied and it is probable that the behaviour which has led to the goal will be repeated when similar need arises. When the goal is not reached it is less probable that these steps will be repeated in future. The basic demands of job satisfaction involve higher income, fair salary system, actual chance for promotion, considerate and participative management, adequate degree of social interaction during work, interesting and various tasks and high level of working dynamics and methods of work control. The satisfaction level of people highly influences their own needs, expectations and work environment (Bucháčková, 2003). An example of factors influencing motivation is presented in Figure 4.

### 3 OBJECTIVES 3 CILJEVI

The problem of employees' motivation was solved for the needs of BUKÓZA Preglejka, a.s., Hencovce, one of the biggest and most important metallurgical manufacturers in Slovakia. BUKÓZA Preglejka, a.s., Hencovce uses the following motivation factors: payments and allowances, education of employees and other advantages.

According to motivation criterions used in the compa-



Slika 3. The process of motivation (Zámečník, 2000).  
 Figure 3 Poticajni proces (Zámečník, 2000).

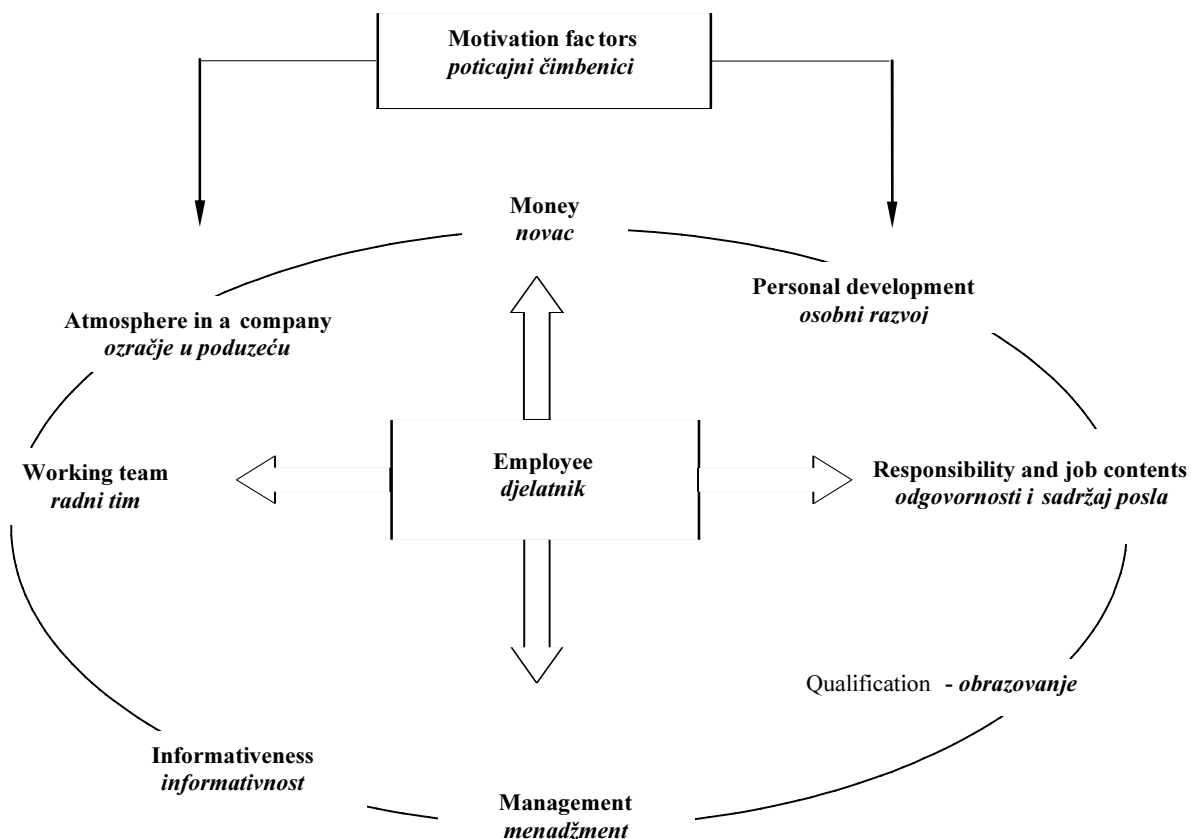
ny it is necessary to identify the following questions for improving the current system of workers' motivation:

- analyse current conditions of workers' motivation,
- find other motivation factors with high influence on workers' performance and also verify if, apart from primary motivation factors (measured or estimated), there are also the so-called latent motivation factors (hidden, unmeasurable) acting in the background of primary motivation factors,
- check the possibility of different unification degrees

of motivation program for workers with the aim of their effective application in practice.

#### 4 MATERIAL AND METHODOLOGY 4 MATERIJAL I METODOLOGIJA

The analysis of motivation structure is based on general knowledge of the theory of motivation and together with the analysis of employees' motivation profile it enables us to obtain information about strong and weak aspects of the management system within an



Slika 4. Example of motivation factors structure (Bucháčková, 2003).  
 Figure 4 Primjer strukture poticajnih čimbenika (Bucháčková, 2003).

organization and its motivation impacts (Grenčíková, 2000). Without this basic knowledge every suggestion is only a stochastic process, which will miss the goal when it does not correspond to employees' priorities (Brodský, 2004). The most important criterions for employees' performance are those that make employees feel that their work makes sense, which is important for an employer, interesting for employees, and which give to employees the possibility of their personal development. However there are also other factors which affect the employees' performance - career growth, adequate financial reward, suitable working environment and interpersonal relationships and last but not least respect of personal honour.

Maslow's hierarchy of needs has been widely accepted, especially among active managers. This is due to the logics and easiness by which this theory is intuitively understood.

Before the analysis of motivation structure, all events having a serious impact on company activities, workers' willingness to work and workers' performance should be understood and evaluated. For this purpose the following information should be provided:

- technical and organizational conditions of work,
- social and demographic features of employees and qualification level,
- information about characteristics of the work environment, work conditions and social equipment of individual jobs,
- applied systems of evaluation and rewarding,
- application of personal management system and individual work in a company,
- application of social welfare system and employees' benefits in a company,
- collection and analysis of the so called soft data (information on workers' satisfaction or dissatisfaction, their value orientation, aspirations, relation to work, relation to superiors, to fellow-workers and to the whole company).

After the analysis of the above presented social and economic information, an outstanding motivation program can be developed for employees.

The data were obtained from BUKÓZA Preglejka, a.s., Hencovce by a questionnaire consisting of 25 motivation factors (Table 1).

The answers to the questionnaire questions provided information on ordinal qualitative variables. From the methodology point of view this is a classic multidimensional matrix: objects (workers) x attributes (motivation factors). The cluster analysis was used for testing the possibility of developing unified motivation programs for groups of workers with similar motivation profile. The goal of the analysis was to determine whether it was possible to select groups with similar profile of motivators for which uniform motivation programs could be developed so as to simplify and support the effective program application in practice. Moreover, the cluster analysis has been used for more detailed testing of the structure and rank of motivation criterions according to their importance. From a

big set of hierarchical cluster techniques, we have chosen hierarchical (tree) clustering by Ward's method with the measurement of similarity level of particular answers by the simplest method known as Euclidean distance. The whole process was established so as to suit qualitative, nonmeasurable factors (motivation factors) applying a uniform scale (values from 1 to 5).

The questionnaire was filled by 150 respondents which means a 75 % return. The respondents had to consider the motivation factors and assign them the value from 5- the most important to 1- unimportant.

## 5 RESULTS 5 REZULTATI

The list of motivation factors and their ranking by summed points is shown in Table 1. The results show that not only money, employees' education and other employees' benefits can motivate people, but that there are also other motivation factors which have an important impact on their work performance. The other important factors are: job security, fair salary system, job content, company's interest in employees' welfare, relationship among employees and relationship with superiors etc.

The analysis of the motivation criteria structure of workers' in BUKÓZA Preglejka, a.s., Hencovce is shown in Figure 5. The tree in Figure 5 presents the cluster analysis of 25 motivation factors. The clusters of mutually related motivators were created by the principle of hierarchically agglomerated procedures, which is based on gradual assigning of motivation factors to groups. At first, very similar factors are clustered and later on less similar motivators are assigned.

The first cluster of motivators consists of *money, job security, fair salary system and company's interest in employees' welfare*. The given criteria correspond particularly well among themselves and they can be called financial-security cluster. The above motivators are considered to be the most important ones because they are directly related to key human values - health, ensuring a proper standard of living for themselves and their families.

The second cluster consists of motivators such as *job content, relationships among employees, good organization of job performance, working atmosphere and stress*. The given criteria can be called work-related criteria. These criteria are also very important because they create respect among employees, membership of work teams and they result in synergy aimed at achieving a single goal - effective management of the company.

The third cluster is formed of the following motivators: *employees' benefits, work time, suitable position and prospects, personal growth, good relationships with superiors and company image*. The motivators related to this cluster are *self-respect and working schedule during a shift*.

The third motivation group can be called self-realisation and personal ambition motivators. This cluster is also related to another group of motivators

**Tablica 1.** Ranking of motivation factors in BUKÓZA Preglejka, a.s., Hencovce  
**Table 1** Rangiranje poticajnih čimbenika u BUKÓZA Preglejka, a.s., Hencovce

Ranking Rangiranje	Motivation factor – Poticajni čimbenik	Total Ukupno
1.	Money – novac	723
2.	Safe job – siguran posao	713
3.	Fair salary system – pošten sustav plaća	633
4.	Job content – sadržaj posla	627
5.	Company's interest in employees' welfare – zanimanje tvrtke za djelatnike	619
6.	Employee's benefits – prednosti djelatnika	606
7.	Relationships among employees – odnos među djelatnicima	596
8.	Good organization of job performance – dobra organizacija poslova	594
9.	Good relationship with superiors – dobar odnos s poslodavcem	588
10.	Work time – radno vrijeme	586
11.	Personal growth – osobno napredovanje	584
12.	Company's image – ugled tvrtke	576
13.	Suitable position and prospects – odgovarajuća funkcija i perspektive	571
14.	Award for good performance – plaća za dobro obavljen posao	568
15.	Working atmosphere – ozračje na radnome mjestu	564
16.	Self-respect – samopoštovanje	559
17.	Stress – stres	553
18.	Environmental protection in a company – ekološki uvjeti u tvrtki	549
19.	Working schedule during a shift – radni raspored tijekom promjena	546
20.	Management style of superiors – stil upravljanja poslodavca	540
21.	Estimation of individual skills and abilities – poštovanje osobnih vještina i mogućnosti	515
22.	Participation share of men and women in a work team - udio muškaraca i žena u radnom timu	505
23.	Tolerance – tolerancija	461
24.	Social care of a company – socijalna briga tvrtke	447
25.	Ergonomic design of specific jobs - ergonomski projektirano radno mjesto	438

and namely *praise for a good performance, company's environmental protection and management style of superiors*. Motivators of this cluster are less important and in comparison with the second cluster they prefer individual differences. So it can be assumed that the third group of motivators will play an important role in potential establishment of individual motivation programs and that motivators will add individual difference to the unified motivation program.

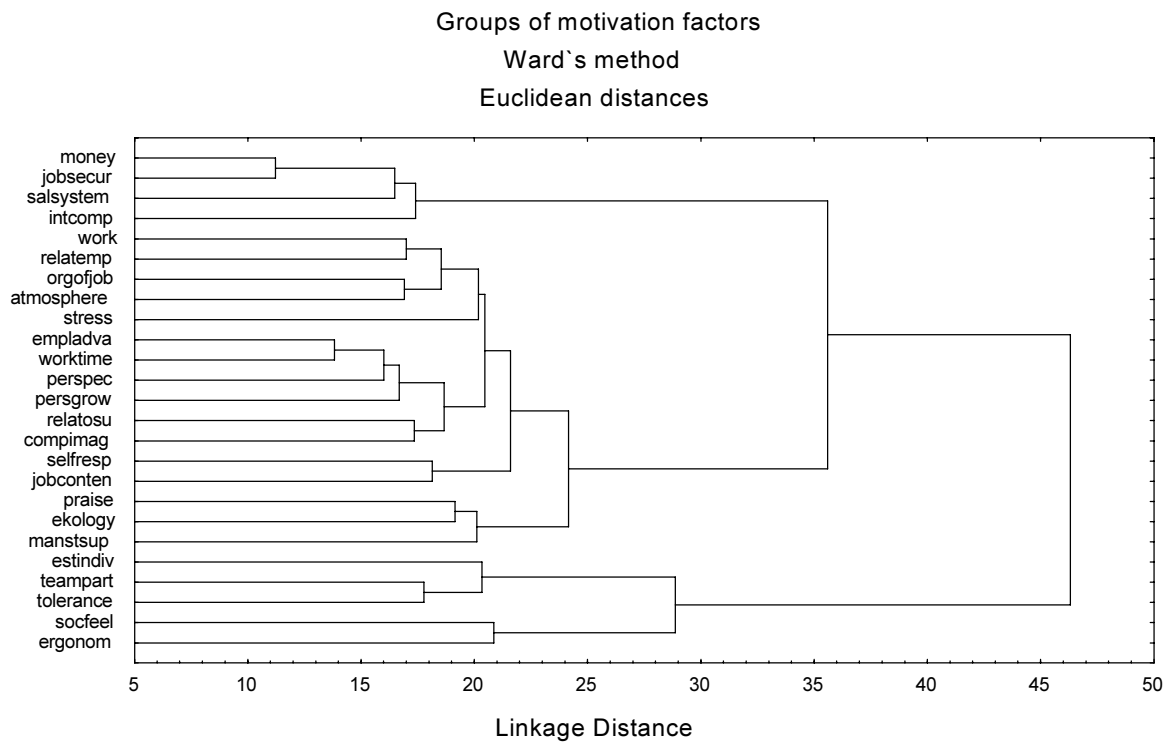
The following group of motivators are *estimation of individual skills and abilities, participation share of men and women in a working team, tolerance, social care of a company and ergonomic design of specific jobs*. These motivators are less interesting from the point of view of workers (Table 1).

The analysis of individual worker profiles is shown in Figure 6. This chart should only be considered as general information. 4-6 groups can be chosen (notwithstanding the difficulties) from a big amount of respondents but when we tried to interpret the formed groups, no presentable results have been reached. A negative result was obtained although various combinations of hierarchical clustering methods and criteria have been tested. Hence it has been concluded that employees' answers are very similar in general. It indicates that a unified motivation program can be installed in a chosen company. The program has to be aimed at the most important motivators shown in Table 1, grouped in the first and second cluster.

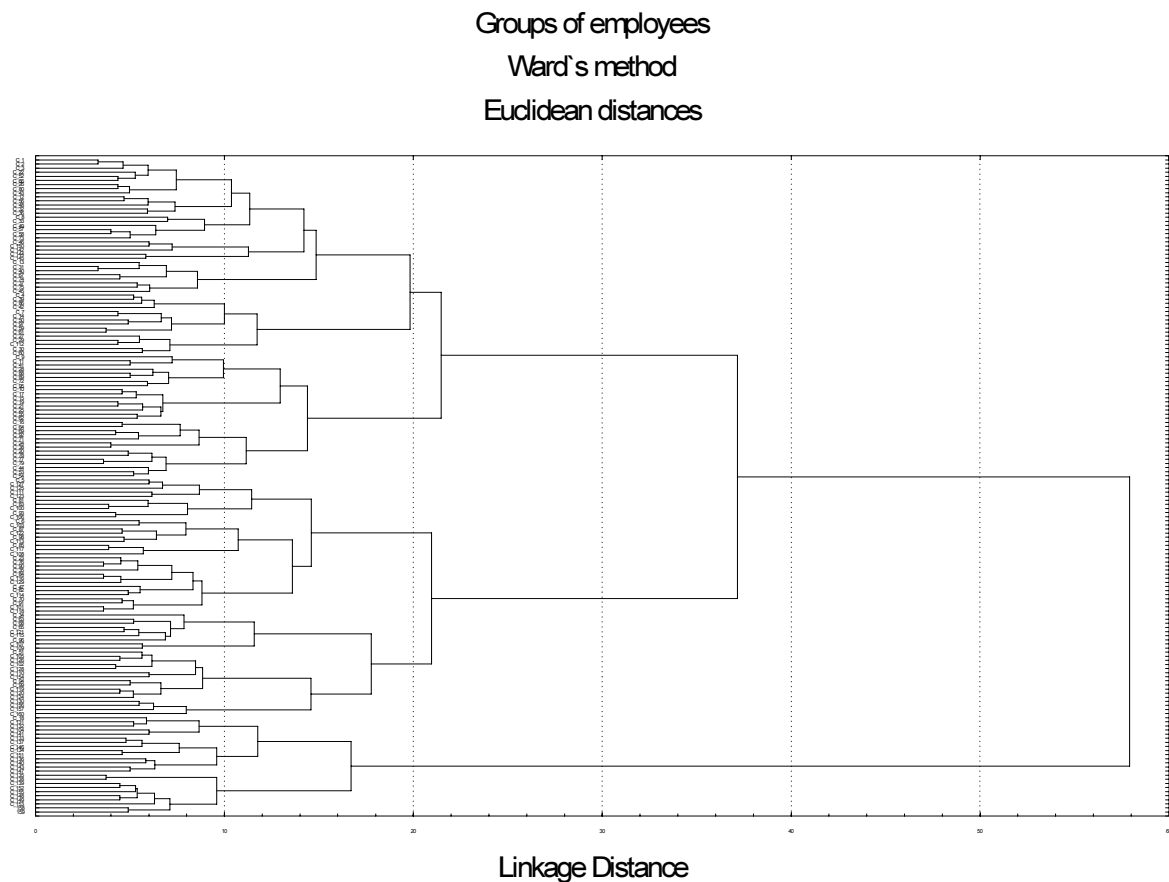
## 6 CONCLUSION 6 ZAKLJUČAK

Proposal and implementation of an effective motivation program is one of the key management tasks of each company. Incorrectly proposed and applied motivation programs have a negative impact on employees, who are not motivated to achieve maximum performance. Nowadays, motivation of workers fails to cover all their needs in production companies.

On the basis of our analysis and results obtained we can say that it is possible to work out and implement a unified motivation program for workers in BUKÓZA Preglejka, a.s., Hencovce. At the same time we have to emphasize that the proposed unification for workers should also be elaborately processed and tested in another production company with similar production program and finally the results should be compared and verified. We also want to emphasize the importance of continuous updating of motivation programs according to the trend of workers' value orientation which can vary in time. Eventually, a general motivation program can be individually focused by the motivators related to self-realisation and personal ambitions of individual workers.



**Slika 5.** Hierarchical cluster analysis of motivation criteria structure of workers in BUKÓZA Preglejka, a.s., Hencovce  
**Figure 5** Hijerarhijska klsterska analiza strukture poticajnih čimbenika za radnike u tvrtki BUKÓZA Preglejka, a.s., Hencovce



**Slika 6.** Hierarchical cluster analysis of individual worker motivation profile in BUKÓZA Preglejka, a.s., Hencovce  
**Figure 6** Hijerarhijska klsterska analiza poticajnog profila za pojedinog radnika u tvrtki BUKÓZA Preglejka, a.s., Hencovce

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