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## INCREASING A LARGE PETROCHEMICAL COMPANY EFFICIENCY BY IMPROVEMENT OF DECISION MAKING PROCESS

*The paper shows the results of a research conducted in a large petrochemical company, in a state under transition, with the aim to "shed light" on the decision making process from the aspect of personal characteristics of the employees, in order to use the results to improve decision making process and increase company efficiency. The research was conducted by a survey, i.e. by filling out a questionnaire specially made for this purpose, under real conditions, during working hours. The sample of the respondents is representative for the goal of the research and consists of 82 employees, of all levels of decision making, education, age structure, and years of service. The data was processed by appropriate mathematical-statistical techniques: factor analysis, cluster analysis, correlation. For determining the important factors in decision making process, a type of factor analysis was used - the principal components analysis and the normalized Varimax rotation procedure. The basic hypotheses of research, related to the readiness of the employees for independent decision making, readiness for risk taking, determining the level of usage of intuition, organization atmosphere, general and personal characteristics of employees, have been proven. The results of the research indicate that the decision making process is a complex one in the organization and that there is a tendency of the employees towards collective decision making, as it used to be done. A significant result is that the employees at the managing positions are more ready for independent decision making than the employees at the executive positions. Based on the results of the research, it is possible to draft managerial and organizational measures for increasing the level of readiness for independent and individual decision making, as well as increase company efficiency.*

Today, companies operate and grow in a business environment which changes at an increased pace and the old work processes are often not adequate for the new circumstances. The business challenges that organizations are facing today include globalization, differentiating data and knowledge management, continual competition through innovation and productivity. In the new socio-technological environment the old assumptions no longer apply, only "concrete truths" do. In view of the possibility that bad decisions cost companies vast sums of money, more attention is paid to the improvement of the decision making process and to preparing all employees for quality decision making.

The decision making process is the key process for the survival of a company as well as for securing its long term efficiency. Today, modern technology is more widely used in the decision making process. Elements of human intelligence are being integrated into modern computer programs which enable the development of systems and help making decisions in complicated, undefined and/or unclear situations.

In modern organizations nowadays there are two basic approaches to the decision making process, depending on the situation and the complexity of the problem [1]:

– traditional, analytical approach to decision making includes a systematic approach in solving problems. Managers have mapped out steps which they follow when they are making decisions.

– Intuitive model of decision making is based on sample recognition and is also based on previous experience [2]. Intuition is usually described as spontaneous knowledge where one does not use logical or analytical reasoning. Whenever something is decided, the final decision always involves a contribution of the intuitive part of a brain.

Upon making decisions, companies, especially large ones, encounter the following problems:

– the decision is being made too slowly. The process of making a decision is taking too long because of the unresolved issues which are dealt with iteratively, step by step.

– negative prejudice like "this is never going to work" interfere with decision making.

– Over-relying on previous experience takes the decision making process in continued, familiar direction.

– Over-generalizing leads to neglect of important factors and problems.

– Members of the decision making group do not share the same standpoint when it comes to a problem and hide their true feelings. Although it seems that a decision will be made, they behave in an obstructive way and prevent the making of a decision and taking any action.

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– The decision is made, but the implementation is taking too long.

– The decision that was made is bad. The consequences of the decision are not the ones that were predicted in the decision making process.

Every decision is backed up by assumptions about facts, competition and customer reaction, employees' needs and their interests. When those assumptions are visible, they can be tested or discussed with others. It is dangerous, however, when those assumptions are subconscious and the decision is based upon them. Therefore, decisions should be made based on criteria. It would be useful if we could rationally estimate how limited is the human capacity for making a decision in a complex situation. If an explicit way for 'moving' through complexity is not found, mistakes are made. The decisions are usually made from several alternatives which are tested in more criteria. Critical point in the decision making process is the estimation of importance of certain criteria. So, there are more alternatives, more criteria, the criteria are of various importance and the effect of the decision depends on the moment of making the decision. There is often a conflict between how the decision maker sees the problem and what the problem really is.

The environment in which the decision is made also affects the quality of decision making. In familiar conditions it is easier to make high-quality decisions, whereas in uncertain and unfamiliar conditions, where there is a high level of uncertainty, an assessment of the probability of success of the decision has to be made, and risk has to be taken. One of the factors coming from the environment is the *control factor*. In externally controlled organizations managers' decisions can suit centres of power outside the organization.

An important limiting factor in decision making is the scarcity of the following resources: time, human resources, information, and money. Corporate values and tradition of an organization can further narrow down the number of alternatives and thus influence the process of decision making. In practice, a paradox has occurred many times in the sense that when there is a wide array of alternatives, the result is a poor decision or no decision is made, leading to a phenomenon of "paralysis in analyzing and decision making".

Having all this in mind, an extensive research on decision making process has been conducted in a large petrochemical company in Serbia, a typical country under socio-economic transition, with an aim to improve human resource management and company efficiency as the final goal.

### Theoretical background and methodology

The decision making process represents the most important segment of modern business and can be considered as one of the most important characteristics of

management. In regard to the complexity of the problem, research was performed which enabled distinguishing important factors in the decision making process and their relation with the process. For this reason, defining the problem of the research was guided by the many layers of the decision making process that need to be approached from many different angles. Up to now, the decision making process was mostly approached from the aspect of a company. New business conditions, which have changed role of man in the work process, put the individual under the spotlight. Through literature survey [3–6] and interviewing human resource managers, the following criteria for decision making were spotted: knowledge, skills and abilities (this criterion includes general and technical knowledge such as: languages, computer skills, programming, analytical abilities, statistic analysis). In business conditions in a country under transition, there is a problem with decision making which is, most of the time, not being dealt with enough care. Because there is a heritage of directed economy in which the employees have only appeared to make important decisions in organization when actually they were not expected to make decisions regarding their own work. In new conditions of the economic and social transition in a country under transition, the decision making process has been burdened with problems that transition brings:

- the existence of multiple alternative development strategies;
- large number of parameters which affect the decision;
- existence of several decision makers which have different standpoints on the problem, and can also have conflicting goals;
- large number of economic and organizing problems which obstruct the decision making;
- no existence of real information;
- long term negative experience in a country under transition and the region which affects the level of independence in decision making.

In researching the process of decision making, the following pointers are found relevant: readiness of the employees for independent decision making, readiness for risk taking, determining the level of usage of intuition, organization atmosphere, general and personal characteristics of employees.

The research was conducted by a survey, *i.e.* by filling out a questionnaire specially made for this purpose, in real conditions, during working hours. The data has been processed by appropriate mathematical-statistical techniques: factor analysis, cluster analysis, and correlation. Factor analysis is a statistical method used to describe variability among observed variables in terms of a potentially lower number of unobserved variables called factors. Factor analysis searches for such joint va-

riations in response to unobserved latent variables. The observed variables are modeled as linear combinations of the potential factors, plus “error” terms. The information gained about the interdependencies between observed variables can be used later to reduce the set of variables in a dataset. Factor analysis is related to principal component analysis (PCA) but not identical. Because PCA performs a variance-maximizing rotation of the variable space, it takes into account all variability in the variables. In contrast, factor analysis estimates how much of the variability is due to common factors (“communality”). Another tool used in statistics, Varimax rotation is a change of coordinates used in principal component analysis and factor analysis that maximizes the sum of the variances of the squared loadings. It seeks a basis that most economically represents each individual, so that each individual can be well described by a linear combination of only a few basic functions. Finally, cluster analysis or clustering is the assignment of a set of observations into subsets (called *clusters*) so that observations in the same cluster are similar in some sense. Clustering is a common technique for statistical data analysis used in many fields, including data mining and pattern recognition.

The methodological plan of the research was based on correlation between general, demographic variables (independent variables) and readiness for decision making, readiness for risk taking, understanding of the organizational climate, use of intuition, presence of fear when making decisions and readiness for team work (dependent variables).

For determining the important factors in decision making process, a type of factor analysis was used – the principal components analysis and the normalized Varimax rotation procedure. For some answers the cluster analysis was applied, *i.e.* the grouping of results was done by using certain criteria. Within the statistical analysis the descriptive analysis to describe certain variables was also used. The general characteristics of the sample are shown graphically, in percentages as well as the premises which describe the situation in which the survey was conducted.

## RESEARCH IN REAL CONDITIONS

The main goals of the research were to examine the relation between general traits of employees on one side, and readiness for decision making, readiness for risk taking, assessment of climate for decision making, the usage of the intuitive way of decision making and fear of making decisions on the other side, as well as the readiness of employees for team decision making. The final goal was to suggest solutions that will improve the process and the company efficiency as well.

The research was conducted in a large petrochemical company in Serbia, which produces a wide range

of petroleum products and other types of fuels. The company employs more than 10,000 people. It has a complex structure including integrated and well balanced system of production, refining and trade of crude oil and petroleum products, as well as natural gas exploitation. Annual crude oil production totals *ca.* 1 million tons.

The sample of the respondents is representative for the goal of the research and consists of 82 employees. They are mostly engineers and technicians from the domain of primary company activity. Basic characteristics of the sample are employee’s level of decision making, education, age structure, and years of service. In the research the nature of workplace in relation to the criteria of the managing-executive workplace was highlighted.

Seven levels of decision making have been defined:

- 1) corporation level, 6%,
- 2) company level, 2%,
- 3) management level, 7%,
- 4) sector level, 11%,
- 5) department level, 21%,
- 6) engineer level, 35% and
- 7) technician level, 18%.

Five levels of education have been defined:

- 1) PhD level, 2%
- 2) master’s degree level, 4%,
- 3) bachelor’s degree level, 73%,
- 4) associate degree level, 6% and
- 5) high school level, 15%.

Age structure is divided into five segments:

- 1) up to 25 years of age, 1%,
- 2) 26 to 35 years of age, 24%,
- 3) 36 to 45 years of age, 23%,
- 4) 46 to 55 years of age, 35% and
- 5) more than 56 years of age, 17%.

Years of service have also been divided into five segments:

- 1) Up to 5 years, 18%,
- 2) 6 to 10 years, 17%,
- 3) 11 to 20 years, 17%,
- 4) 21 to 30 years, 36% and
- 5) More than 31 years, 12%.

The research was conducted by a survey, *i.e.* by filling out a questionnaire specially made for this purpose, in real conditions, at the employees’ workplace, during working hours. The basic methodological plan of the research was based on correlation between general, demographic variables (independent variables) and:

- 1) readiness for decision making,
- 2) readiness for risk taking,
- 3) understanding of the organizational climate,
- 4) use of intuition,
- 5) presence of fear when making decisions and

6) readiness for team work (dependent variables).

During research the random sampling method of questioning has been used. The goal was to show the complexity of influences and efficacy of factors which affect the decision making process with a questionnaire which consists of 25 items. The questionnaire was designed on the basis of closed type of questions which are categorized by the degree of agreement which would suit the standpoint of the respondents the most. The scale of agreement with particular items from the questionnaire was given in the following way:

- 1) I completely disagree,
- 2) I disagree,
- 3) I am indecisive, I neither agree nor disagree,
- 4) I agree and
- 5) I completely agree.

Information about the respondents and their personal characteristics implied the acquiring of the data which we thought would be most relevant for the problem of the research, and it is related to the following four independent variables:

- hierarchical level of decision making,
- level of education,
- age and
- years of service.

The general hypothesis in this research was that employees show readiness and ability of independent decision making, while the specific hypotheses were as follows:

*H1.* The way of decision making in an organization is related to the general demographic characteristics of the employees.

*H2.* Personal attitude towards decision making as in readiness for decision making and fear of decision making are related to the general demographic characteristics of the employees.

*H3.* The attitude towards risk in decision making is related to the general demographic characteristics of the employees.

*H4.* The assessment of the organizational climate by the employees is related to the way of decision making in the organization.

*H5.* The way of decision making is related to readiness for decision making, risk in decision making and fear of decision making in the organization that was questioned.

This research has been performed in the wider scope of an investigation on decision making process. In this paper only an outline of results is given and analysed, focused on a climate for decision making process and readiness for decision making from the perspective of the level of decision making and years of service.

## RESULTS

In purpose to present climate for decision making process in the company, the number of employees indicating the need for a change is plotted against the level of decision making (Fig. 1). From Fig. 1 one can argue that:

What needs to be changed in the company in order for it to do better business?

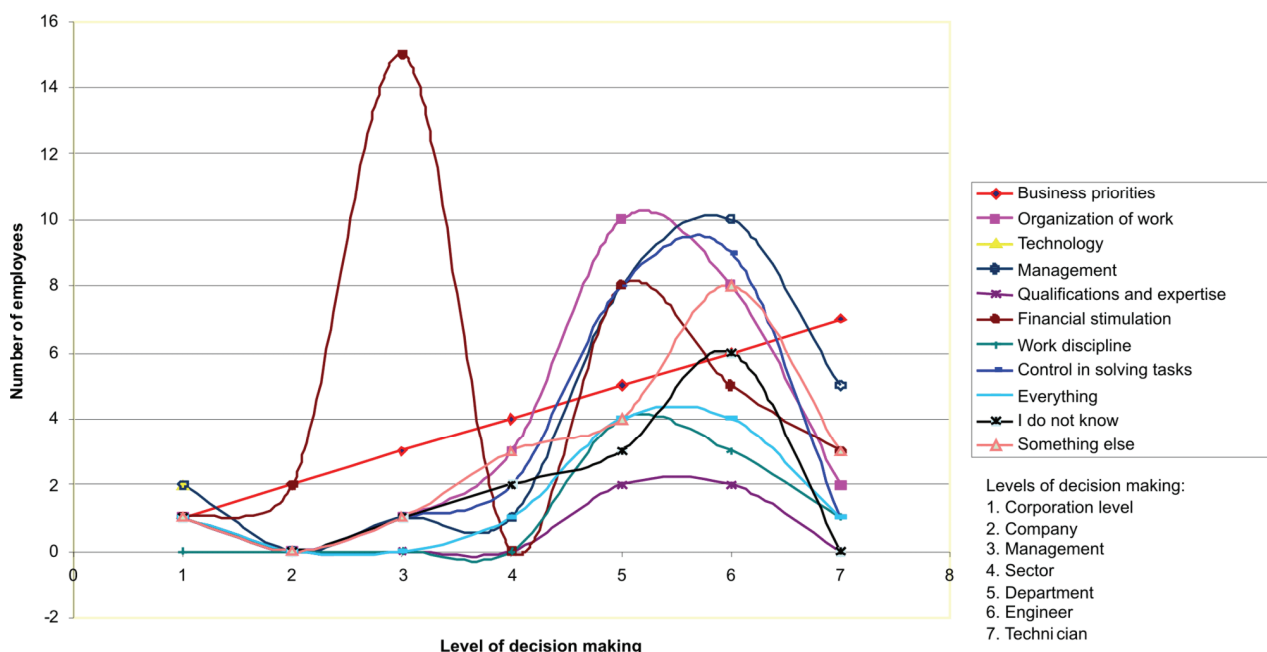


Figure 1. The number of employees indicating the need for a change versus the level of decision making.

– More and more respondents think that business priorities and the investment policy should be changed, as the decision making level drops.

– Most of the department managers and engineers (executive level) think that the organization of work and managing should be changed. This can be explained by a critical attitude towards business conduct on behalf of those who are not directly involved in setting business priorities, investment policy of the company and organization of work.

– That everything should be changed, this is mostly the opinion of the respondents at the lowest levels of decision making. The response that everything should be changed carries in itself a certain level of dissatisfaction with the job. It is logical to expect such an answer from this group of respondents, if we assume that the lower levels of decision making enjoy work less because of no or very little participation in creating and developing business assignments, and also their lower income and thus poor motivation.

– That financial stimulation should be changed, this is how higher level executives and employees at the lower level of decision making think. The financial stimulation issue can be linked to the general economic situation in the society where financial stimulation is externally controlled and it does not significantly depend on work results, so both the higher and lower levels of decision making are dissatisfied with it.

– A smaller number of respondents think that work discipline and qualifications and expertise of the employees should be changed. The response to this question considered positive, because most of the respondents are satisfied with the work discipline and the possibilities for professional development.

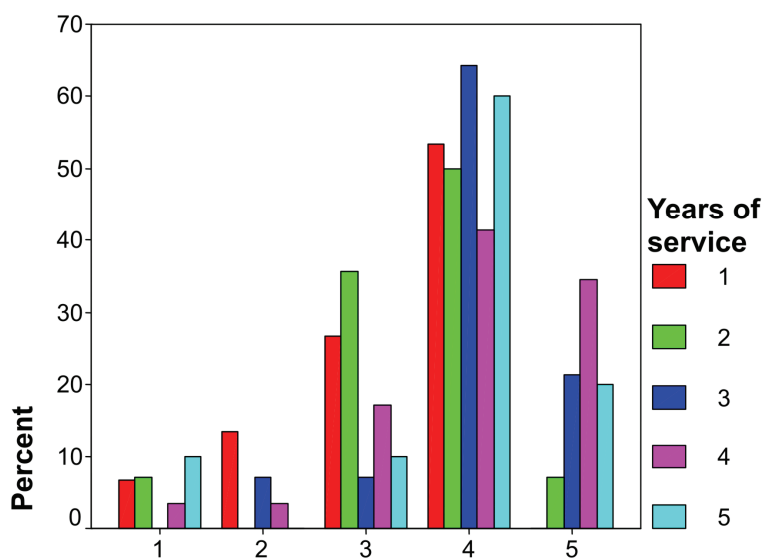
– Most of the respondents are satisfied with the technological level of the company.

There is a positive correlation between years of service and successful predicting of future developments in the business, which can be expected because a successful prediction depends, among other things, on experience. In this survey the experience is treated as the number of years of service spent on some specific job. Figure 2 shows graphically, in percentages, the results of the cluster analysis about the ability of prediction in relation to the years of service. The numbers on the abscissa indicate the level of agreement with the premise “I can predict in advance when something can go wrong”. One can see that among those who completely agree with the premise, there are no respondents with the least number of years of service. Also, there is a correlation between readiness for risk taking and the ability to use personal as well as other people’s experience.

Figure 3 shows graphically, in percentages, the results of the cluster analysis about the use of intuition in relation to the level of decision making. The numbers on the abscissa indicate the level of agreement with the premise “I can predict in advance when something might go wrong”. One can see that among those who completely agree with the use of intuition there are no respondents from the highest levels of decision making.

## DISCUSSION

The research has shown that both communication between employees and the way of decision making is a big problem in the company.



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Figure 2. Cluster analysis about the ability of prediction in relation to the years of service.

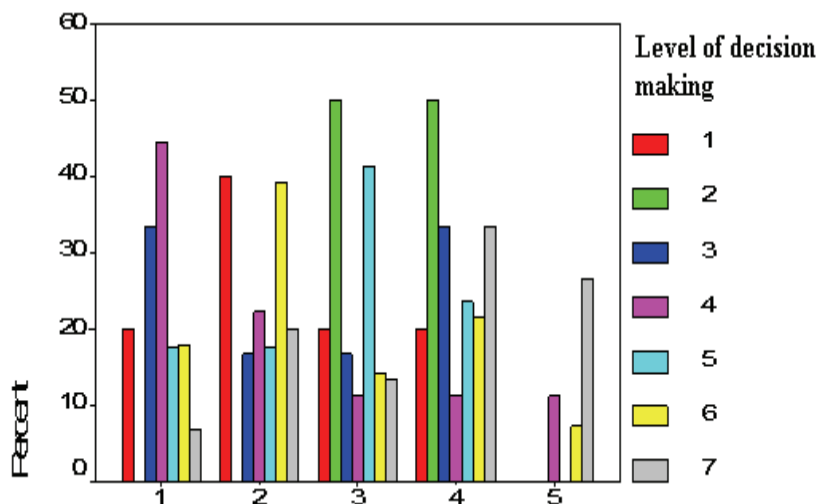


Figure 3. Correlation between the level of education and the use of intuition.

There is a positive correlation between the level of decision making and the standpoint that before making a decision one should have a clear goal about the consequences of the decision in the sense that the higher level of decision making has a more vivid picture about what the decision is solving. There is a positive correlation between taking part in the decision making process and the responsibility towards the job and the driving force with which job is done.

Organizational and social atmosphere in which the decisions are being made can be viewed through employees' standpoints on the problems in the organization, when 69% of the respondents think that decision making is one of the largest problems in the organization, and only 14% do not think there is a problem in decision making. Also, a large percent of the employees (49%) think that the communication between employees is not open and clear, which points to human relations which do not encourage independent and responsible decision making.

The assumption about the relation between the decision making process and the personal characteristics of the decision maker and the way of decision making has been confirmed. It has also been confirmed that the way of decision making in the company is related to the general demographic characteristics of employees. It has been demonstrated that the tendency towards team decision making is related (positive correlation) to the level of education and the hierarchical level of decision making.

The personal attitude towards decision making, in the sense of readiness for decision making and fear of decision making is related to the general demographic characteristics of employees. The research has shown that the feeling of intense fear when a tough decision has to be made depends on the hierarchical level of the decision maker and the level of education, and it does

not depend on the age and the years of service. Workers at the sixth level of decision making, which represents the executive, engineer level, with the bachelor's degree level, experience fear the most when making important decisions. Also, 51% of the respondents think that the fear of making a mistake affects the behaviour of the employees, while 22% think that the fear of making a mistake does not affect their behaviour at all. There is a positive correlation between the premises "I gladly accept that someone else makes decisions for me" and "I like it the most when I do not have to make any kind of decisions". There is a positive correlation between the premises "I gladly accept that someone else makes decisions for me" and "I feel intense fear when I have to make a tough decision".

The attitude towards risk taking in decision making is related to the general demographic characteristics of the employees. The research has shown that the readiness for risk taking does not depend on the age structure and the years of service, and it does depend on the level of decision making and the level of education of the respondents. If the decision does not meet the expectations, a larger number of respondents (58%) modify their goals without major difficulties. There is a correlation between readiness for risk taking and the ability to reduce the negative effects of the potential failure. The average respondent who is ready to take a risk because they are sure they will succeed, is at a lower hierarchical level and accordingly, he or she makes decisions at the operative level.

The climate in the company in relation to human relations affects the way of decision making. The research has shown that the way of decision making is a big problem at the organization and so is the communication between the employees. Most respondents work with more incentive on a job where they have been involved in the decision making. It was shown that the

responsibility is bigger with those respondents who make their own decisions about their work.

The way of decision making is related to readiness for decision making, taking risk in decision making and the fear of decision making in the researched organization. The survey has shown that the respondents, on average, do not like when someone else makes decisions for them, know when the right time is and place for commencing an activity, know what they are solving with the decision, and are capable of making a decision among several choices. Those who are at the lower hierarchical level of decision making think that the fear of making a mistake greatly affects the behaviour of the employees.

The research has shown the existence of a positive correlation between the number of years of service, age and the level of decision making with having a clear goal about what the decision is solving. There is a positive correlation between the opinion that having alternatives prevents the decision making and the standpoint view that people like it the most, when they do not need to make any kind of decisions.

Research shows that individual approach to decision making is important issue for establishment of the managing culture of autonomous decision making and individual responsibility, in the organizations that face the problems of transition as the whole society does.

Regarding the previous period when the decision making was based on the quasi-self-governed model, the new conditions require decision making training and establishment of new management culture where the individual responsibility for decision making is desired model of managing style.

The results of the research point to an undeveloped system of decision making, especially when it comes to possibility of individual decision making, which opens and launches a whole range of other researches that deal with organizational culture, climate, responsibility process and others.

The results of the research also show that the process of decision making is complex in the company and that there is a tendency of the employees towards col-

lective decision making, as it used to be done. A significant result is that the employees at the managing positions are more ready for independent decision making than the employees at the executive positions.

## CONCLUSIONS

From the aforementioned one can conclude that:

- Involvement of the employees in the decision making process would increase their efficiency and responsibility and thus enable an easier implementation of the decisions that have been made.

- The employees who have a good risk assessment make decisions easier.

- The fear of making a mistake significantly affects the behaviour of the employees, so by creating a good organizational climate a higher quality decision making would be induced.

- Improving the communication in the researched organization would affect the improvement of the decision making process.

- Based on these conclusions, the managerial and organizational measures for increasing the level of readiness for independent and individual decision making, according to their responsibilities, and increasing company efficiency as well, can be drafted.

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**IZVOD****UNAPREĐENJE PROCESA DONOŠENJA ODLUKA S CILJEM POVEĆANJA EFIKASNOSTI VELIKE PETROHEMIJSKE KOMPANIJE**Snežana D. Kirin<sup>1</sup>, Leposava G. Nešić<sup>2</sup>, Ilija P. Čosić<sup>2</sup><sup>1</sup>Naftna industrija Srbije<sup>2</sup>Fakultet tehničkih nauka, Univerzitet u Novom Sadu, Novi Sad, Srbija

(Naučni rad)

U ovom radu su prikazani rezultati istraživanja sprovedenog u velikoj petrohemijskoj kompaniji u državi koja je u tranziciji sa ciljem da se „osvetli“ proces donošenja odluka iz aspekta personalnih karakteristika zaposlenih, a da bi se na osnovu tih rezultata unapredio proces donošenja odluka i povećala efikasnost kompanije. Radi toga je sastavljen specijalni upitnik pomoću kog je ispitan uzorak od 82 zaposlena, svih nivoa odlučivanja, starosti, iskustva i obrazovanja. Obrada rezultata se zasnivala na statističkim metodama, kao što su faktorska, klaster i korelaciona analiza. Važni faktori u procesu donošenja odluka su utvrđeni primenom analize glavnih komponenta i normalizovanom Varimax procedurom. Potvrđene su osnovne hipoteze istraživanja vezane za način donošenja odluka, za odnos zaposlenih prema procesu donošenja odluka i prema odgovarajućem riziku, kao i za organizacionu klimu i za opšte demografske karakteristike zaposlenih. Rezultati istraživanja su pokazali da je proces donošenja odluka komplikovan u ovakvoj kompaniji i da postoji tendencija zaposlenih ka kolektivnom odlučivanju, kao što je to bio ranije slučaj u centralizovanom sistemu. Bitan rezultat je i da su zaposleni na menadžerskim pozicijama spremniji za nezavisno donošenje odluka nego zaposleni na nižim hijerarhijskim položajima, što je uslovljeno i organizacionom kulturom koja doprinosi načinu donošenja odluka. Na osnovu rezultata istraživanja moguće je dati preporuke na nivou menadžmenta i organizacije kompanije za podizanje nivoa spremnosti zaposlenih za nezavisno i individualno donošenje odluka, što bi dovelo do povećanja efikasnosti kompanije.

Ključne reči: Proces donošenja odluka • Velika petrohemijska kompanija • Povećanje efikasnosti kompanije  
Key words: Decision making process  
• Large petrochemical company • Increase of company efficiency