COMPARATIVE STUDY ON THE BEHAVIOR UNDER THE EFFECT OF TEMPERATURE VARIATIONS OF TWO STEEL STRUCTURAL ELEMENTS OF THE INCHEON GRAND BRIDGE, SEOUL, SOUTH KOREA

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Abstract. As we have shown in the previous paper, the structure of the Incheon Grand Bridge Seoul, South Korea is composite, made of concrete and some elements of steel plate-deck type. It was shown before that for the monitored working, six Sonorange UPK sensors were installed on two elements of concrete bridge from north line gap, bridge gap from south line, and on four of steel, 24th lamella from south line, first lamella from north line, first lamella from south line, second lamella from south line. This paper makes a compared analysis the structural response of two steel structural elements, First lamella from south line, respectively, First lamella from north line under the effect of temperature variations of the material they are made of: steel. Finally, this paper contains references of the previous study on the structural response of reinforced concrete elements, making a comparison between the two sets of results, i.e. mathematical models developed using different software. The monitored period is still 2010, processing data collected hourly, every two or four hours. The mathematical modelling of structural monitoring becomes a utilitarian extension of it, the simple presentation of the cause-effect data set, in this case the temperature variation-sensor motion, does not expressively show the whole process nor does it allows the designer to validate his predicted mathematical model during the design phase regarding the structural behaviour. The authors intend to develop this area by future work, especially for bridges with exceptional features and very tall buildings, the actual engine of the entire Structural Health Monitoring activity.

Keywords: Structural Health Monitoring, Incheon Grand Bridge, First lamella from south line, First lamella from north line, Sensors, Mathematical model

INTRODUCTION

The transformation occurred in all components of the “Tracking the behaviour in time of constructions”, thus passing from sequential monitoring to continuous monitoring of structures; classical measurements performed in static regime were made whole by those taken in cinematic regime; classical instruments, theodolite and level joined forces with tools such as sensors, accelerometers, pendulums, etc.; taking atmospheric data and other structure load factors, like hourly traffic on a bridge, have become very important, being taken synchronously with the time evolution of the structure’s state (Rădulescu, 2015). The amount of information used in a Structural Monitoring action has become very large, virtually infinite, because the combinations that can be analysed from data recorded in quasi-continuous regime (at intervals of a few seconds to several minutes) are endless. In these circumstances, information management becomes difficult, time consuming,
possibly chaotic, without a system to order by clear criteria the huge volume of information, selecting the options that may be important benchmarks for the engineer in his activity, i.e. validation of design solutions based on SM results.

**MATERIALS AND METHODS**

4. Checking the accuracy of the data collected every 15 minutes for the entire year 2010. During 2010 over 35,000 pairs of data were collected. Processes by the IBM SPSS 21 software, the result (Figure 1) is not convincing, showing a very low degree of accuracy of 44.5%, which demonstrates that the data distribution will not allow the creation of reliable mathematical models by linear regression. The authors will continue trying, by a similar selection of data, to build mathematical models of the behaviour of metal bars under sunlight that would show a correlation coefficient significantly greater than 0.9, which is also valid with the original data.

![Fig. 1. The IBM SPSS 21 report received consequently to the introduction of the 35,000 initial pairs of data on the response of the sensor installed on the First Lamella from North Line structural element to temperature variations](image)

Figure 2 shows the predicted occurrence frequency of the data relatively to those observed.

Figure 3 shows the line that would represent the rank 1 linear equation, close and median to the cloud of points given by the pairs cause (X - air temperature), effect (motion of the sensor installed on First Lamella from North line). We attempt a first iteration by removing 98 pairs of data deemed undesirable after the introduction of the basic data in the IBM SPSS 21 software, but instead to increase, the accuracy will decrease to 44.1% (Fig. 4) which demonstrates that there are still a large number of pairs of data to be removed, in fact analysing the cloud of points created, we can see that this time only about 40% of the pairs of data would align into a mathematical model, which no longer represents the entirety of records. The question we must ask after reading the previous work and the first part of this paper is: do the reinforced concrete structural elements have a linear behaviour under the effect of temperature while the metallic ones have a nonlinear behaviour? The authors will demonstrate in the following that the previous statement is not entirely true. Another metallic element lamella 24 south line has a linear behaviour.

To demonstrate this, we input the data from 2010 in the IBM SPSS 21, the 35,000 pairs, and first we obtain an accuracy of 77.6% (Fig. 5) and after the removal of only 6 precised pairs of data (Fig. 6) we reach 84% (Fig. 7) Practice has proved that by completing 10-15 iterations by removing a limited number of data pairs, approx. 700-1000 in total, i.e. more than 3%, we can achieve an accuracy of more than 0.9 and a correlation coefficient close to 0.95.
Fig. 2. Predicted by Observed for First Lamella from North Line, for all 2010 monitored period

Fig. 3. Estimated Means charts for the top ten significant effects (p<0.5) are displayed for First Lamella from North Line

Fig. 4. The IBM SPSS 21 report after the first iteration

Fig. 5. The IBM SPSS 21 report received after the introduction of 35,000 pairs of initial data regarding the response of the sensor installed on the structural element 24 Lamella from South Line to temperature variations

Fig. 6. The IBM SPSS 21 report regarding the data that needs to be removed
5. Creating the mathematical model for the data selected from monitoring the First lamella from North line element. Here, we select 124 data pairs of the recordings made in 2010 so as to cover all temperatures the structural element was subjected to, degree by degree, with three characteristic values of the position of the sensor, maximum, average and minimum. Processing the mentioned data pairs in the Table Curve 2D software, we obtained the report in Figure 8, from the aspect of the graph resulting the conclusion that in this case we can expect a mathematical model-equation with a correlation coefficient close or exceeding 0.9.

The Rank 1 equation is:
\[ y = a + bx + c/x + d x^2 + e/x^2 + f x^3 + g/x^3 + h x^4 + i/x^4 \]  
(1)

With coefficients:
\[ a=0.131215981, \quad b=-0.00109940, \quad c=0.004409426, \quad d=6.836 \ e^{-0.5}, \quad e=-0.00010554, \quad f=-1.4127 \ e^{-0.6}, \quad g=-0.00057755, \quad h=-1.2961 \ e^{-0.8}, \quad i=-6.9572 \ e^{-0.5} \]
and a correlation coefficient:
\[ r^2=0.7260240975 \]
That is a weak result and we check if it gets significantly better in the following iterations. The primary equation is of Rank 47 and \( r^2=0.6330391975 \) is of form:
\[ y=a+bx \]  
(2)

The graphic representation of equation 1 is shown in figure 8 and the range of residual values in figure 9.
After analysing the data we graphically remove 4 pairs of data (colored in yellow in Figure 9 and far from the graph in Figure 10) and 2 data pairs using IBM SPSS 21.

Introducing again the remaining data pair in the software results in a better mathematical model with a correlation coefficient of 0.7625067132, the equation has the same form as (1), and the coefficients are:

\[a=0.130729698, b=-0.00097434, c=0.001958796, d=7.17998e^{-0.5}, e=-0.00026751, f=-1.9242e^{-0.6}, g=-0.000186118, h=-3.6884e^{-0.9}, i=4.06145e^{-0.5}\]

It should be noted that the form of equation (2) is in the case of Rank 45 \(r^2=0.6576863803\)

Four data pairs are removed after iteration 1, two graphically and two analytically. The remaining data pairs are returned to the software and the result is a equation of rank 1 of the same form as equation (1) with the coefficients:

\[a=0.131043279, b=-0.00087778, c=0.001588257, d=6.8651e^{-0.5}, e=-0.00043297, f=-2.1309e^{-0.6}, g=-0.000288911, h=2.55805e^{-0.9}, i=5.83562e^{-0.5}\]

With \(r^2=0.7592128356\). Decreased in relation to the previous iteration.

We graphically remove eight pairs of data, IBM SPSS 21 no longer indicates data that can not be correlated and we reintroduce the remaining data in the processing software. The result is an equation of rank 1 of the same form as equation (1) with the coefficients:

\[a=0.132277453, b=-0.00079069, c=0.002690663, d=5.93262e^{-0.5}, e=-0.00042403, f=-2.4151e^{-0.6}, g=-0.00020316, h=1.60041e^{-0.8}, i=-1.2562e^{-0.5}\]

With \(r^2=0.8122310438\) increased in relation to the previous iteration, but still below 0.9, considered to be the lower limit of the correlation coefficient in order to indicate a linear mathematical model. To verify, we further remove by successive iterations, or directly by the analysis of the graph of the order 1 function, of form \(y=a+bx\), which in this case is of rank 56 and has \(r^2=0.7351658817\), are shown in figures 11, 12 and 13 the graphs related to iteration 2.

The graph shown in Figure 12 indicates that all data pairs in green, more than half of the total, should be removed, which would lead to a database that would no longer represent the entirety of records.
6. Creating the mathematical model for the data selected from monitoring the First lamella from South line element. By processing the data collected in 2010 in the IBM SPSS 21 software, we obtain a low degree of acuity, similar to the previous case, so in this case there are no initial conditions to create a linear mathematical model for the selected data pairs. The data selection was made in the same way as before and by processing the selected basic data with the 2D Table Curve software, we obtain an equation of rank 1 of the form of equation (1) with coefficients: \( a=0.114891693 \), \( b=-0.00096504 \), \( c=0.003848542 \), \( d=6.42951e^{-0.5} \), \( e=0.000258648 \), \( f=-1.5084e^{-0.6}\), \( g=-1.5084e^{-0.6} \), \( h=9.1075e^{-0.8} \), \( i=-7.2567e^{-0.5} \) and a correlation coefficient: \( r^2=0.6952408375 \), lower than
the original obtained in the previous case. The graphical representation is shown in Figure 14 and it is noted that the data field is similar and equally dispersed as in the previous case.

A number of 20 data pairs are removed graphically and one is removed with IBM SPSS 21, the remaining data are input in the processing software resulting in a Rank 1 equation of the same form as equation (1) with the coefficients: a=0.115958613, b=-0.00098016, c=0.000579118, d=5.68311e-0.5, e=-7.8929 e-0.5, f=-1.0012e-0.6, g=-0.00359327, h=-1.8172e-0.8, i=5.60517e-0.5 and a correlation coefficient: r²=0.8173709356. That is close to the desired value of 0.9. We further remove 38 data pairs graphically and one with the software, the remaining data is re-input in the processing software, resulting in an equation of the following form:

\[
y = a + bx + c/x + d x^2 + e/x^2 + f x^3 + g/x^3
\]

with \( r^2 = 0.8959997535 \) and coefficients: \( a = 0.116486602, b = -0.00098156, c = 0.007876520, d = 4.34758e-0.5, e = 0.011890055, f = -1.1137e-0.6, g = 0.004350013 \)

We also remove graphically 13 pairs of data and three using the software, obtaining an equation identical to the previous one but with a correlation coefficient of \( r^2 = 0.9163140127 \), therefore a good one. The equation coefficients are: \( a = 0.118116223, b = -0.00099449, c = 0.008679673, d = 2.71682e-0.5, e = 0.00236579, f = -5.9889 e-0.7, g = -0.00770394 \). The question is: if 49 pairs of data, less than 40%, remain of the 124 data pairs, is this, equation (3), a significant mathematical model, real and valid to represent the movement of the first lamella from South line structural element? The answer will be discussed in the next chapter. In this case the primary equation of form (2) has a correlation coefficient close to the one desired, 0.8823782348 respectively, being of Rank 63, the first 22 equations have a correlation coefficient greater than 0.9, but the question remains. The graph of function (2) is shown in Figure 15, and the graph of residual values in Fig.16.
Fig. 16. Graph of residual values on the correlation between aer temperature and sensor position, FL SL, Iteration 3, Rank 63 equation of form y=a+bx

RESULTS AND DISCUSSIONS

From any cloud of points representing data on structural monitoring it is possible, by selecting data, to obtain mathematical models with a correlation coefficient greater than 0.9, thus reflecting a linear behaviour of the structural element analysed under the considered charge. There is a problem that was mentioned previously, the remaining data after the selection made by successive iterations, do the still represent the analysed phenomenon? The authors’ answer is negative and the argument is that we believe that a mathematical model is valid if it is built for more than 90% of the initial data.

CONCLUSIONS

Trying to build mathematical models for the data resulted from SHM activity does not always return results. You cannot make general statements, "the material made of this material behaves linearly or not under the effect of a charge, in this case the effect of temperature variations". We believe that it comes down to the wit and skill of those who make such enterprises to know where to stop with the selection of data and when the remaining data are no longer representative for the analysed phenomenon. We believe that this new dimension, that of mathematical modelling, that concludes and gives shape to structural monitoring, is extremely useful for designers of structures who, by comparing actual models, built similarly to those made in the design phase, can validate their design solutions therefore making a progress in giving new dimensions to the structures designed.

REFERENCES

GENERAL ASPECTS REGARDING THE PRESENT SITUATION OF AREAS AFFECTED BY SUBSIDENCE PRODUCED BY EXPLOITATION OF ROCK SALT BY DISSOLVING

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Abstract: The exploitation by dissolution has different characteristics compared to other types of exploitations, because these types of exploitations are exposed to uncontrolled dissolution phenomenon, which may occur in rapid subsidence and collapse, depending on the value of the hydraulic gradient. Study of areas affected by the exploitation of salt by dissolution was and is a constant concern of those in charge with the exploitation but has not been analysed in detail. The research was limited only to monitor the phenomena and to find solutions for eliminating the consequences than knowledge and removing the causes.

Keywords: uncontrolled collapse, underground holes, instability, subsidence, monitoring

INTRODUCTION

In Romania the exploitation of salt through dissolution with probes is applied in the case of four deposits of salt, respectively Ocna Mureș, Ocnele Mari, Târgu Ocna and Căcica. The exploitation method by dissolution using probes, forms inside the mountain of salt, systems of various shapes and sizes goals, prompting the change of the magnitude and direction in which the force acts rocks. Exploitation of underground deposit (opening, preparation and abatation) inevitably entails disturbing primary state (natural) voltage rock massif. To ensure the stability of the area, both during the exploitation activity and its cessation, it must be known the direction of action and intensity of deformation processes and the displacement of rocks in mining works, depending on the type of deformation character works (opening preparation, exploitation), the pressure that can develop the outlines of works, displacement and deformation mechanism processes of rocks in space and time. After the extraction of a volume of salt from a reservoir, the state of stresses and strains of the massive salt change, resulting in destruction of surrounding rock stability, fractured rocks on the perimeter of the excavation is put in motion, the movement is transmitting in the massive on a distance that depends on their ability to fill the gap created after the operation. If the hole resulted through exploitation is very high, exceeding the possibilities of the surrounding rock to fill and stop the phenomenon of deformation of rocks, their movement can affect the land surface, causing its degradation and thus destroying the surface or underground targets.
MATERIAL AND METHOD

The phenomena of instability manifested so far in mines in Romania have determined (in addition to expenses resulting from the removal of the effects) immobilizing large amounts of reserves through the establishment of some areas with restrictions for exploitation, thereby reducing the degree of recovery. In Romania, uncontrolled crashes of underground caverns were numerous: in the 80s collapsed the ceiling of dissolution hole from Târgu Ocna exploitation, creating a lake in the middle of the town, Lake Burlacu. In 2001, occurred the accident of gargantuan proportions in the Field II of Probes - Ocnele Mari. After this accident, this resulted in the expulsion of a volume of about 2 million m³ of concentrated brine, also occurred another two accidents that led to the partial collapse of the same cavern in 2002 and 2004. The collapse of this cavern triggered processes in a chain that caused instability of another cavern from the Field I of probes (made up by joining the holes of eight probes from this field). Following decommissioning of the two fields mentioned in Ocnele Mari, a total of 200 homes were displaced (practically were created two new localities, Copăcelu and Cazaneşti).

RESULTS AND DISCUSSIONS

The phenomenon of instability triggered in Field II of probes from Ocnele Mari (in 2001) has generated large-scale collapses, highlighting that the lack of complex techniques and technologies for monitoring, forecasting and prevention but also some shortcomings in carrying out and managing technological process, it led to the dissolution of pillars throughout their entire section, resulting a hole with a horizontal section of approx. 105,000 m² and a height of between 40-60 m.

Along with the controlled collapse process of the ceiling in the Field II, was implemented a system for micro seismic monitoring of the area, which includes Field I and the interpretation of data recorded in real-time at the micro seismic station provides important information for predicting the buckling process area [4]. In late December 2010 it took place a phenomenon of subsidence of land adjacent the supermarket "Plus", positioned immediately in south-eastern limit of the salt diapir from Oena Mureş. This event was the intrusion of a volume of tailings underground and the expulsion of an equivalent volume of brine, which led to the formation of Lake Plus. Throughout the period of exploitation of salt from Oena Mures have taken place land surface collapses, which generated at the surface a series of lakes filled with brine (Lake Ştefania, Lake Iosif,
Lake 1 May, Lake Minele Romane). The peculiarity of the event in December 2010, is that it is the first lake formed outside the contour diapir, all previously formed lakes being placed inside it.

![Field of probes - Ocna Mureș](image)

a) the crash from December 2010  
b) the fissures appeared around the crater

At Ocna Mureș, the existence of underground mining voids which are interlinked and collapse of access shafts have created favorable conditions for infiltration of groundwater in underground horizons, causing the weakening of the resistance elements (pillars, floors) and a decline of some works. The effects of this subsidence transmitted to the surface accentuated the depression of the area, which adversely affects groundwater dewatering the river Mureș. The formation of the subsidence funnels and their intersection with groundwater led to the formation of lakes with large dimensions, through which the hydraulic connection is achieved between the phreatic and the backs massive and the flooded underground voids.

The processes associated with this collapsing continues today, extending the crater and the newly created lake surface and extending the fissures around the crater, fissures that have a the tendency of evolution to several apartment buildings in the area (including former Tax Office building of Ocna Mureș) [5]. The phenomena of instability in the field of probes from Ocna Mureș, represent a major risk over the city Ocna Mures, in addition to water and soil pollution by hydrocarbons. From the existing data until now, the biggest problems that occur at the salt exploitations in the wet are Ocenele Mari (Field II - cavern Socon and Field III of probes), Ocna Mureș (the newly formed lake Plus) and Târgu Ocna (probe S 251).

**CONCLUSIONS**

The extent of the instability phenomena vary from one deposit to another, according to their specificities and permanent monitoring of influence is absolutely necessary. The main factors contributing to maintaining the overall stability or destruction of dissolved salt deposits are exploited:

- The geological and hydrogeological characteristics of the salt deposit;
- The shape, size and distribution of voids in relation to the deposit area;
- The form and dimensions of the pillars;
- The behaviour in time of the resistance elements;
- The mining method applied.

Exceeding the projected radius determine the realisations of the hydraulic links through the underground voids, reducing the pillars lift and finally collapses (situations...
encountered in Ocnele Mari, 2001). Along with the emergence and development of the dissolving voids created by the salt exploitation activities, due to the convergence of the voids and the deformation of the resistance elements, appear movements which can be transmitted to the surface, depending on the volume of their extent, geometry, depth or distance from the surface voids. Constant monitoring of the areas of influence is essential in order to detect the possible distortions in its infancy. Areas of influence of salt deposits are unsuitable for construction in general and for multi-storey buildings in particular. If the building's location in areas of influence is unavoidable, measures will be taken not to adversely alter water regime, measures consisting of: capture, drainage, sewage, regulating waterways, avoiding accumulation (dams). Boreholes (of any type) made in the areas of influence will be cemented to avoid the massive penetration of salt water.

Currently, since there is not the possibility to fight definitively the instability processes at the salt exploitation activities, must be expected from the beginning of the design, methods, procedures and technologies for preventing and reducing the risk. Solving the complex problems in managing the risk situations involves inputs from a wide range of diverse specialties having regard not only the phenomena of instability and damages caused, but the whole complex of circumstances that have created favorable conditions for them to occur [2]. In order to determine the degree of risk in areas affected by the exploitation through dissolving the salt is required a simulation of the stability criteria, taking into account the actual conditions of the salt deposits in Romania. Based on these simulations may establish conditions under which it may produce instability phenomena [1].

REFERENCES

THE OPINION OF CLUJ CITIZENS REGARDING THE SMOKING IN PUBLIC PLACES

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Abstract. In 2009 the European Council adopted a Recommendation on Smoke-free Environments. The European Recommendation called on member states to introduce specific smoke-free legislative measures until November 2012. Romania is one of the few European states where smoking is still allowed in closed public spaces. The country did not adopt the recommendations of the European Union Council, according to which all the member states should enforce measures to protect the citizens against exposure to tobacco smoke. The majority of the European Union countries have comprehensive smoke-free laws in place. Studies on the health effects of smoke-free legislation indicate that positive impacts appear very quickly after starting to implement smoke free legislation. During January 2013, it was launched a civic initiative on the adoption by Cluj-Napoca the European recommendations about banning smoking in some public places. The purpose of this study was to find out the opinion of the inhabitants of Cluj-Napoca city on smoking and the possible ban on smoking in enclosed public places within the city. This study, the first in the city about this subject, uses the method of sociological research based on a questionnaire survey, using a representative sample of the city population. The majority of the subjects support the initiative of banning smoking in enclosed public places in Cluj-Napoca, and consider that this measure must be extended nationwide.

Keywords: Sociological study, Recommendation on Smoke-free Environments, sample, smoking, public places.

INTRODUCTION

In November 2009 the European Council adopted a Recommendation on Smoke-free Environments. The European Recommendation called on member states to introduce smoke-free legislative measures by November 2012. Smoke-free environments should be created in particular for "indoor workplaces", "indoor public places" and "public transport". The main objective of smoke-free environments is to protect European Union citizens against the exposure to second hand tobacco smoke. A Euro-barometer survey of March 2009 found 84% of European Union citizens in favor of smoke-free offices and other indoor workplaces, 77% in favor of smoke-free restaurants, and 61% supporting smoke-free bars and pubs1. Currently, 15 European Union countries have comprehensive smoke-free laws in place. For example, Ireland, the United Kingdom, Greece, Spain and Hungary have the strictest smoke-free provisions with a complete ban on smoking in enclosed public places, on public transport and in workplaces.

Recommendation calls on European Union member states to provide effective protection from exposure to tobacco smoke in indoor workplaces, indoor public places and public transport. Special emphasis was placed on measures to protect children. The Recommendation invited member states to introduce smoke-free environments no later

than November 2012 and invited the European Commission to report on the implementation, functioning and impact of the measures\(^2\). According to estimates, over 79,000 adults, including 19,000 non-smokers, died in the European Union -25 in 2002 due to the exposure to tobacco smoke at home (72,000) and at their workplace (7,300).\(^3\) According to the medical tests, tobacco use leads most commonly to diseases affecting the heart, liver and lungs, with smoking being a major risk factor for heart attacks, strokes, chronic pulmonary diseases and cancer. It also causes peripheral vascular disease and hypertension. The effects depend on the number of years that a person smokes and on how much the person smokes. Starting smoking earlier in life increases the risk of these diseases. Also, environmental tobacco smoke has been shown to cause adverse health effects. The World Health Organization estimated that tobacco caused 100 million deaths over the course of the 20th century. As well, “cigarette smoking is associated with cognitive decline and dementia, but the extent of the association between smoking and structural brain changes remains unclear”\(^4\). The conclusions of another research indicates that “Smoking acutely impaired glucose tolerance and insulin sensitivity, enhanced serum cholesterol and triglyceride levels, and raised blood pressure and heart rate. These findings support the pathogenetic role of cigarette smoking on cardiovascular risk factors.”\(^5\)

During January 2013, it was launched a civic initiative on the adoption by Cluj-Napoca the European recommendations about banning smoking in some public places. Unfortunately, Romania is among the last European Union countries that is not harmonized with the European law regarding banning smoking in public places. The initiative has received generous media coverage and broad support from the public.

**MATERIALS AND METHODS**

This study uses the method of sociological research based on a questionnaire survey, using a representative sample of the city population. The sample is consisting of individuals both smokers and non-smokers. It was made a sociological study in the city of Cluj-Napoca, in order to see the opinion of Cluj-Napoca inhabitants on local adoption of European recommendations about banning smoking in enclosed public places. The survey used a representative sample of 1180 people, and the confidence level is 95%. In choosing the number of subjects was taken into account in the population proportion of people smoking and smoking. It was used the stratified random sampling. The subjects were randomly selected from the specific groups of the population (older than 18 years, 38.7% of respondents being smokers, and 61.3% non-smokers). The questionnaire used 12 closed questions.

**RESULTS AND DISCUSSION**

The results of this study will present the respondents opinion on smoking, about the initiative to ban smoking in enclosed public places according to the European


recommendations on smoking, the respondents' awareness about the effects of smoking and with the law on this phenomenon and other issues related to this topic. In Figure no. 1, 61.3% of the respondents present in this study do not smoke, and the rest, 38.7% are smokers.

![Figure 1. “Do you smoke?”](image)

In Figure no. 2, the most of the respondents (55.5%) agree with the current trend to ban smoking in enclosed public places. 32.8% do not agree this idea, and 11.8% are indifferent to this topic.

According to the Figure no. 3, 36.1% of the respondents has neither good, neither bad perception about Romania being among the last European Union countries that has not banned smoking in enclosed public places. 32.8% of respondents has a bad perception of that reality, and 21.8% has a very bad opinion. Only 6.7% has a good opinion, and 2.5% a very favorable opinion.

The most of the respondents, 54.6% never heard about our initiative of banning smoking in enclosed public places in Cluj-Napoca. The rest, 45.4%, know about the existence of this initiative. The last figure (Figure 5) shows that the most of the respondents, 52.1% agree the initiative of banning smoking in enclosed public places in Cluj-Napoca, and consider that this measure must be extended nationwide. 35.3% of subjects are against this proposal and the rest, 12.8% are not interested in this problem.
Figure 3, “What is your opinion about Romania being among the last countries of the European Union that has not banned smoking in enclosed public places?”

Figure 4, “Did you know about the initiative of banning smoking in enclosed public places in Cluj?”

Figure 5, “What is your opinion about banning smoking in enclosed public places in Cluj-Napoca?”
CONCLUSIONS

In conclusion, it has been good progress in transposing the Recommendation on smoke-free environments into national law of the European Union member countries. The European countries had report that they have adopted measures to protect their citizens from exposure to tobacco. Also, studies on the health effects of smoke-free legislation indicate that positive impacts appear very quickly after starting to implement smoke free legislation. The Romanian authorities also should look more carefully the subject and have more determination in the application of such measures benefit public health. The Romanian Parliament and local authorities must realize the importance of adopting such measures on smoking. The majority of the respondents (52.1%) that agree the initiative of banning smoking in enclosed public places in Cluj-Napoca, and consider that this measure must be extended nationwide. In March, 2015, the law forbidding smoking completely in Romania's public places has been debated in the Parliament, passed by the Senate and it will go to the Chamber of Deputies.

REFERENCES


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HUMAN RESOURCES AND MARKETING MIX IN OIL & GAS INDUSTRY

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Abstract. In the actual global knowledge society, all organizations have human resources systems implemented. What will make differences between organizations? people and their capacity to adapt, to sell themselves, to sell ideas, to sell projects. The paper intends to present connection between human resources and marketing in a dynamic and complex field, in oil & gas industry. Why and what means the “4P” and how your employees can apply in their organizational life can make a difference between organizations in a knowledge society.

Keywords: marketing mix, human resources, knowledge society

JEL classification: M31/O15

The petroleum industry, taken as a whole, is the world's largest industry. It includes the global processes of exploring, extracting, refining, transporting, and marketing. Oil and gas are the petroleum industry's largest volume products, with oil fueling a large percentage of the world's energy consumption. In recent history, the oil and gas industry has been at the forefront of both economic prosperity and environmental catastrophes:

- 1960, The Organization of the Petroleum Exporting Countries, or OPEC, was formed. OPEC – a formal consortium that includes major oil producing member nations – decides oil production rates, concession rights, and negotiates oil price with multinational oil companies.
- 1973, The world's first modern oil crisis was the result of the Fourth Arab-Israeli War. OPEC members declared an oil embargo on countries that supported Israel. Prices quadrupled between 1972 and 1974.
- 1979, The Iranian Revolution resulted in a second oil crisis, as the pro-Western monarchy in Iran was overthrown and replaced by an Islamic theocracy. Additional oil crises occurred during wars involving Iran and Iraq.
- 1989, The Exxon Valdez oil tanker hit a reef in Alaska, spilling 39,000 tons of oil into the ocean. The spill devastated a large part of Alaska's coastal ecosystem and resulted in new legislation, as well as widespread opposition to oil drilling.
- 1990, During the first Gulf War, over 700 production wells were sabotaged and the valves of an oil terminal were opened, releasing approximately 8 million barrels of oil into the Persian Gulf.
- In 2010, a deepwater drilling rig exploded and sank in the Gulf of Mexico, resulting in the largest offshore oil spill in US history.

Today's oil and gas industry impacts virtually every aspect of modern life, providing energy to four key areas: residential, commercial, industrial, and transportation and human resources.

Changing the educational needs is a consequence of globalization. Therefore, offering alternatives to your own employees regarding their career development may influence their decision of leaving the organization. A study, recently realized by the
American Society of Human Resources Management in 2003, on a group of 473 specialists in human resources, showed that 87% of the employees leave the organizations of their own. As a percentage, 50% of these do not request any contractual changes while 40% leave because the staff had rejected their contractual changes [13]. What does this study show us? It is clear that some adjustment of the management to the labor force’s needs, no matter the level, is necessary. One of the methods is to know and understand the labor force within the organization and adjusting the career plans for each level of the organization. How can manage to know the entire labor force within the organization? I consider that, in any organization, one should take into consideration:

- The creation of a functional system for the identification of all employees’ career anchors;
- The creation of a system for its effective monitoring and management;
- Drawing the career directions/the alternatives’ identification for each employee, no matter the level and nationality, taking into account the ‘career triangle’;

![Fig.1 ‘Satisfaction at work’ triangle [1]](image)

- The existence of a counseling center for the employees, including immigrants, if it is the case;
- The integration of the two management systems, performance and career management;
- The creation of virtual learning centers.

Schein’s career anchors’ theory [11] supports five distinct patterns of talents, purposes and values in his own perception, which appear as a result of the first professional experiences: Technical/functional competence; Managerial competence; Safety; Autonomy; Creativity. The term ‘anchor’ designates the specific nuclei of the individual that are part of his/her occupational identity. What do these ‘anchors’ imply?

- Those who have developed a technical/functional competence are career-oriented, depending on the work nature, and they cannot transfer to a field too distant from the basic one;
- The person that has developed a managerial competence is oriented towards reaching positions that offer responsibilities accordingly. Important is the perspective offered by the occupied position, not the activity contents. What counts is the opportunity to develop analytical abilities, interpersonal competences, and other experiences useful for a future manager;
- Safety is an anchor activating by focusing on a stable position, safe from all points of view. The future evolution is clearly set, both professionally and materially;
- Those who have developed autonomy as an anchor will not stay too long in a specialized field; will not intend to remain in a place where things are clear and planned on a long term, where the promotion scheme is set and inflexible. This type of person needs freedom
and an environment without any constraints. Independence and freedom are more important than promotion itself;

- Creativity manifests itself as an anchor when the individuals are focused on creating something that represents their exclusive accomplishment; satisfaction comes only from the possibility of building, inventing something new, genuine.

The differences resulting from these theories that identify patterns are meant to emphasize the fact that people are not alike, and so the slogan ‘all should be treated alike’ must be reconsidered. Furthermore, in the context of free circulation within the E.U., of the global migration phenomenon, it is possible for the Romanian employee to have to work in a team with the one abroad. The career plans, the performances’ evaluation have to be reconsidering taking into account the mobility of the qualified and non-qualified labor force. An equal behavior may prevent the capitalization of resources so different in each of us. What means a chance for an individual (the task of creating and implementing a system, for instance) may be a frustrating situation and a feeling of helplessness for another (a creative individual versus a technical one). Similarly, not all people have the capacity and will to lead; in such a situation, those who lack this kind of abilities will be frustrated and incapable of fulfilling the role expected from them.

Treating people differently within the organization is necessary, namely:

- Understanding and identifying the individual differences;
- Understanding the cultural differences;
- Identifying the key positions and the congruent situational factors;
- Developing the people’s ways of adjusting to the professional environment factors;
- Creating a common space in order to remove the cultural barriers.

From this point of view it is important for each organization to keep its valuable people, through the managers who, in their turn, should be capable of developing the people they lead. In a personal discussion with a manager about what one should do in order to succeed in one’s career, about what luck represents in one’s career, he said that ‘luck is a chance, but the chance should find you prepared’. How well prepared are the Romanians in the Romanian organization, in oil and gas companies? How prepared are they to work in a team with immigrants? These are only a few questions to which the management should have answers in order to influence people’s leaving from organizations, whether it is emigration, temporary work abroad or changing the organization with another one in Romania. ‘Leadership and management have become more important than ever. The commentators and numerous gurus have proclaimed this for years, maybe because it justified their existence. Now it is reality.’[9] It is the stage when the emphasis lies on raising the human potential and on the social relationships within the organization. The decisions made about the human resources have a particular importance on the economic and social plan. In the short presentation of the human resources management evolution is emphasized the classical approach of human resources. This is a global approach of the employees, as masses present within the organization, highlighted through the phrases ‘labor force’, ‘man power’; and even the training programs were conceived only to raise people’s productivity.

But there has been the need of passing from a global approach of the employees as a mass, to an individual one. In the present context the employee is approached individually, by concentrating on the development of some individual skills. This has been influenced by the international economic crisis which made it obvious that the renewal of human resources management systems represented the only way to avoid being at a loss. Thus, the human resources professional must have competences centered on knowing the people in order to represent a support for a management adapted to the current conditions. He or she must be a support for the employees subject to the changes generated by the working technologies’ fast evolution through computers, in the actual context of globalization in a knowledge society.

In oil and gas industry, the challenges are very higher and the people capacity to sell themselves is very important; It is important for organization capacity also to sell itself in front of their employees but in the same time it is about employee and management capacity to sell their
ideas. In this context, marketing mix has to be applied in all levels: employee’s level, management level and with clients also. The successful organization is the one that will have the capacity to apply “4P” at all organization levels.

"Putting the right product in the right place, at the right price, at the right time” is similar like “Identify the right people, at the right time, in the right bus” [12].

“The 4 Ps is one way – probably the best-known way – of defining the marketing mix, and was first expressed in 1960 by E J McCarthy.

The 4Ps are:
- Product (or Service)
- Place
- Price
- Promotion

The 4Ps model is just one of many marketing mix lists that have been developed over the years. And, whilst the questions we have listed above are key, they are just a subset of the detailed probing that may be required to optimize your marketing mix. Amongst the other marketing mix models have been developed over the years is Boom and Bitner's 7Ps, sometimes called the extended marketing mix, which include the first 4 Ps, plus people, processes and physical layout decisions” [12]. The difference between organizations will be the capacity to keep their employees through marketing tools and human resources tools. As such, one of the reasons for which the employees leave the organization is that, at their working place, they do not think there are any preoccupations from the management’s, the supervisors’ part, for their work’s appreciation and their development as individuals. I think that now, more than ever, in the context of passing from a knowledge-based economy [6] on the background of globalization, the employees feel the need to be treated as distinct individuals, not as masses.

It is very important in this change management to identify a person that has the capacity of being a promoter of change through the “4 P” also. It is estimated that one organization’s adjustment to change night last up to 5 years, and change must begin at the level of the organizational culture. It has been noticed that the organizations, which know how to involve their personnel in the company’s problems, have had better results in a shorter period. Defining some key skills and projecting a training program for their development is very important in the change management process. The new human resources management implies, except for the roles’ clarification, creating a favorable environment for the opening towards the exterior, establishing a communication system able to respond to the employees’ participation needs, stimulating creativity, acknowledging the merits. In order to fulfill these objectives, before requesting anything from the subordinates, the managers themselves should change their behavior. In order to further promote change, the managerial team should understand and believe in it.

The success of implementing a successful human resources management depends on the managers’ capacity, at all company levels, to keep up with change. In the current context, the human resources professional has the mission to support the company in its confrontations with the future’s challenges, since he/she is the one having the necessary knowledge, abilities and instruments to come up with efficient solutions, original forms of work organization, and to promote the new relationship among managers. The new objective of this new strategic management system is represented by the conciliation between the individual goals and those of the organization in order to create more competitive and more human organizations. The new human resources manager is a resource for the employees, a change agent, an administrative expert and a strategic expert for the organization. He/she has to develop a unique human resources strategy and position itself through marketing tool in the organization. Also, he/she has to have the ability to use 4 or 7 P customized for the organization and each level from the whole organization.

Competition means distinguishing between staff reduction, which in Romania is still the main method of reducing costs, and reorganization, which implies a re-dimensioning of the organizational structure, since the new structure is more appropriate for the company’s strategy [2]. Unfortunately, in our country, in the development stage of human resources management, still
In inchoative in many Romanian companies, reorganization is often done according to different reasons, cost reduction being the main one. Recent theories about business strategies define human resources as being the supporter of competition advantages. As I have mentioned above, all organizations have access to high technology now, to material resources. What is the difference then? The human resource, the competitive advantage a company can have. Competition could imitate anything, except for the value brought by the human resource in that organization. Therefore, human resources could be a special source, an important source of competitive advantages.

There is another important advantage. It is hard to imitate, especially in oil and gas industry. A well-implemented human resources strategy cannot be copied by another organization. In order to imitate it, one must know how all system’s elements interact. The connection to what organizational culture means, cannot be copied. Also, the politics developed in time cannot be imitated. A competitor can understand if the system is valuable, but it is risky to implement it immediately, since there are limits given by the managerial competence, the culture, and the interpersonal relationships within the organization. But what can be done in such conditions? Having a competitive human resources strategy will make the difference between organizations. How is this possible? People want more: they want recognition, appreciation for the work they did. Work itself has gained a new dimension in people’s life. It is the object of a trade: reward offered according to the work done; but it also has a social function: the working place offers opportunities to get to know new people, to make new friends. For the most employees work means a social status, offers distinction, integration in society. It has an intrinsic value for the individual. Work gives the individual self-respect and identity;

If at the beginning labor force was seen as a mass of physical energy that produced money, now it has been replaced by machines. Now, labor force is the one that makes the difference and is capable to bring prosperity to the organizations. In this context, motivation can support this value through the behaviors it induces. I think that human resources management is not ready yet for the employees’ avalanche of knowledge, in the context of moving to a knowledge-based economy. In oil and gas industry at international level biggest trends are:

- Increased usage in energy from China and India;
- increased investment in deep-water;
- drilling operations versifying into biofuels developing non-conventional oil;
- At international level energy consumption is expected to rise by approximately 33 percent by 2030.

The growing demand for energy is largely the result of an expanding population, predominantly in the emerging economies of China and India. Both countries are expecting substantial increases in economic output, which will result in a much higher average standard of living. Based on this the connection between human resources and marketing has a major role in a multicultural and knowledge society. The connection between a strategic human resources management, innovation and marketing should be done by the organization based on a knowledge management [4]. We consider that the managers and their attitudes have a primary role, in this context of globalization, in keeping both the qualified and un-qualified labor force within the organization. The organization should create capabilities of raising managers, supervisors with such an approach towards the labor force. They have to be educated as such, and in turn, they have to be followed by the subordinates. In the new ‘funky’ business, the authors of the book emphasize that people should be treated like the celebrities, like the Hollywood stars or the sports champions, like some ladies full of pretensions. You offend them on your own risk. You have lost one, and all of them leave. Stars attract stars; losers attract losers. All of us are actors in the great game of attraction [11].
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