HIGHWAY ENGINEERING SPECIALISTS’ COMPETENCE IN THE TEAM WORK AND NEGOTIATIONS

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Abstract. Highway engineering work involves the need to solve many theoretical, economical and technical problems. The good highway engineering specialist has to be a prominent personality who loves his/her work and satisfies major engineering profession and ethics requirements. He/she should also be creative and ready to organize teamwork, apply various negotiation styles. The aim of this presentation is to explore highway engineering specialist’s competence in the teamwork and negotiations. The results of this investigation are discussed in the paper.

Keywords: personality characteristics, cooperation, teamwork, solution of problems

1. Introduction

The transition from industrial to knowledge society gives rise to the need for new forms and methods of activities. Highway engineering work involves the need to solve many theoretical, economical and psychological problems. To achieve the most efficient cooperation with local and central government authorities and implementation of various norms and standards in practice, specialists of highway engineering must have the skills of cooperation with many people of different attitudes, and be able to conduct negotiations. In many cases, they should behave as members of a team formed for efficient problem solution rather than as individuals. They must be aware of their personal characteristics and try to improve them if necessary. The highway engineer has to be a prominent personality who loves his work and satisfies major engineering ethics requirements. He/she should also be creative and tolerant as well as being ready to develop and prepare up to date projecting programs, participate in construction activities (planning, implementing, evaluating and adjusting them), organize team work (acting as a member of a team, choosing team members, adjusting and controlling their functions and providing the feedback), apply various negotiation styles, make decisions for cooperation with other organizations, be able to communicate, develop discussion skills in identifying practical situations and finding effective solution.

The goal of this research is to explore highway engineer’s competence in the teamwork and negotiations.

2. Methods of investigation

Many important social, economic and technical achievements are made by teams of cooperating specialists rather than by individuals. To become successful in business activities teamwork is a key factor. With the use of teams, the business will receive quicker and more effective solutions to problems. Teams provide more improvements of long duration in processes and operations as well. In teams, every member feel more comfortable bringing up problems that may occur and can receive support from other members of team to find a most usable solution. The investigation of possibilities to form a creative and highly mobile working team involving personalities with different psychological characteristics was conducted involving the leading highway engineering specialists who improved their qualification during the MSc studies at the Vilnius Gediminas Technical University. The capabilities to conduct negotiations using different negotiation styles were investigated as well. More than 50 specialists
participated in the investigation during the period 2004 – 2007.

The following methods were used in this research:

Occupational Personality Questionnaire SHL was used for analysing psychological characteristics of every participant in group work. The British psychologist Meredith Belbin argues that there are no ideal workers but the ideal team is possible [1]. He picked out nine roles – nine team types, which can be represented by every member of the group. Any described type of behaviour is a very important element in the activities of all teams. The team including the representatives of all roles is most successful in occupational and creative work. In our research questionnaire adopted for such purposes in Poland was used and one role (specialist) was excluded [1]. Distribution remaining eight team roles among highway engineers was investigated.

The questionnaire of self-evaluation of negotiation skills used in Warsaw School of Economics was adapted for the purposes of the present research [2]. In testing, every participant had to answer 80 questions expressing his/her opinion on communication with other people. The results obtained enable us to determine the profile of the negotiating style of every participant, as well as the average profile for the whole group.

The above-mentioned methods were used in the investigation of specialists in other areas in Lithuania and Poland [1-3].

3. Psychological problems encountered in forming an efficient team

Fifty-seven specialists were investigated during four years of research. The main purpose was to determine which types of possible eight team roles prevail among the specialists of highway engineering. The experiment was conducted by using a special questionnaire (containing seven groups of questions with eight possible responses in every situation). It took every participant about 30 min to fill it in. After the statistical evaluation of the obtained results, it was possible to present them in graphic form as shown in Fig. 1. In this figure relative distributions for averages of every role were expressed in percent scale calculated by using such equation:

\[ Q_i = \frac{\sum P_i}{n \times 70} \times 100 \% \]  

(1)

where \( Q_i \) is average value for each investigated role \( i \) (\( i \) is varying from 1 to 8) expressed in percents, \( \sum P_i \) is total sum of points for investigated role - \( i \), \( n \) is number of participants, 70 is total sum of points for all eight roles for one participant (this is a sum points of all possible responses for seven groups of questions).

The t-test was used for assessment whether the averages of different team roles are statistically different from each other. This analysis is appropriate whenever you want to compare the averages of two groups. The formula for the t-test is a ratio. The top part of the ratio is just the difference between the two means or averages. The bottom part is a measure of the variability or dispersion of the scores. When number of observations in every group is equal e.g. \( n_1 = n_2 = n \) formula can be expressed in such form:

\[ t = \frac{x_1 - x_2}{\sqrt{\frac{S_1^2 + S_2^2}{n}}} \]  

(2)
where \( x_1 \) and \( x_2 \) are the averages of investigated different team roles in both groups, \( S_1^2 \) and \( S_2^2 \) are the variances of same roles in both groups, \( n \) is the sum of the persons in every investigated group.

In the t-test, the degrees of freedom (df) is the sum of the persons in both groups minus 2 (in our research df=112). In our research the alpha level is set at 0.05. This means that five times out of a hundred we could find a statistically significant difference between the averages even if there was none. For the df, and the t-value, we can find the t-value up in a standard table of significance (in our research 1,96) to determine whether calculated by the formula 2 the t-value is large enough to be significant. If it is, we can conclude that the difference between the averages for the two groups is significant. We can conclude that in our research the role of implementer was different from other seven roles and the role of plant was found different from other seven roles as well. This means that for highway engineers the role of implementer is most desirable and the role of plant is performed as most unacceptable. Another finding of this study is such that roles of shaker and coordinator are used in group work with great satisfaction as well. Difference for this roles was found significant five times out of a seven. From the other hand difference for the roles of resource investigator and completer was found significant also five times out of a seven. We can conclude that these roles were performed in most cases as unsatisfactory.

The team finds the successful solution of the problems, the members of which play different roles. Each specialist of the team may play only one role (the main one), but, at the same time, he/she may be rather competent to perform some minor roles. Sometimes, the existence of two shapers and too many monitor evaluators may cause problems. The situation is not good when the leader who is unrivalled intellectually or creatively among his colleagues dominates in the team. His position and inborn skills allow his vivid domination in the team. However, the team will not be able to function when such a leader leaves it. Each member of the group may feel good when performing several roles. Usually, there will be one role, which is most desirable, and one role, which is reluctantly accepted.

The main features characteristics of all types are presented in Table 1.

The results of the present investigation have revealed that the role of implementer belong to the most acceptable. The role of plant is most unacceptable. The roles of shaper and coordinator are used in many cases with great satisfaction as well. We can conclude that highway engineers are less competent when the team roles of completer and resource investigator for successful team work are needed. Not a single problem or task may be solved successfully unless the team has the participants of two psychological types including implementer and completer. They are the guarantee of quality type for the performance of work and the implementation of all planned tasks. Results of our investigation showed that highway engineers in most cases are not competent when the role of completer is performed.

### Table 1. Characteristic features of different psychological roles played in the teamwork

<table>
<thead>
<tr>
<th>Psychological team type</th>
<th>Advantages</th>
<th>Weak points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinator</td>
<td>Co mature, trustworthy</td>
<td>not always creative</td>
</tr>
<tr>
<td>Shaper</td>
<td>S dynamic, ready to accept challenges</td>
<td>conflicting, provoking other people</td>
</tr>
<tr>
<td>Plant</td>
<td>P creative, full of ideas, with lively imagination</td>
<td>poor ability of maintaining interpersonal relations</td>
</tr>
<tr>
<td>Monitor evaluator M.E.</td>
<td>M.E. capable of strategic thinking, foreseeing all possible solutions</td>
<td>lacking leadership abilities</td>
</tr>
<tr>
<td>Resource investigator R.I.</td>
<td>R.I. enthusiastic, capable of developing contacts, cooperative</td>
<td>quickly loosing enthusiasm</td>
</tr>
<tr>
<td>Completer</td>
<td>Com diligent, capable of finding mistakes, punctual, scrupulous</td>
<td>striving to be an autocrat, concerned about details</td>
</tr>
<tr>
<td>Team worker T.W.</td>
<td>T.W. social, friendly, capable to listen and communicate</td>
<td>indecisive, disliking conflicts</td>
</tr>
<tr>
<td>Implementer I</td>
<td>I efficient, practical, disciplined</td>
<td>conservative, not flexible</td>
</tr>
<tr>
<td>Specialist Sp</td>
<td>Sp provides specialist knowledge</td>
<td>dwell on technicalities</td>
</tr>
</tbody>
</table>

Implementer is the most acceptable role among the specialists of the investigated group. Completer takes the sixth place among eight possible roles, which shows that, in most cases, engineers are less capable of implementing this role in the teamwork as well (see Fig. 1).

**4. Investigation of negotiation skills**

Fifty seven leaders of highway engineering enterprises were investigated for their negotiation skills. During this test every participant had to answer 80 questions to determine his/her opinion about communication with other people. It took every respondent about 20 min to fill in the questionnaire. The results obtained allow us to determine the profile of the negotiating style of every participant, as well as the average profile of the whole group. There are four main styles of negotiating: intuitive (I), normative (N), analytical (A) styles and the style based on the facts (F). When the data were statistically evaluated, it was possible to present them in the form demonstrated in Table 2.
Table 2. Distribution of highway building specialists using different styles of negotiating

<table>
<thead>
<tr>
<th>Statistical parameters</th>
<th>Data on using various negotiating styles</th>
<th>I</th>
<th>N</th>
<th>A</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average – X</td>
<td></td>
<td>61,5</td>
<td>66,5</td>
<td>69,7</td>
<td>67,9</td>
</tr>
<tr>
<td>Standard deviation - S_y</td>
<td></td>
<td>7,6</td>
<td>7,2</td>
<td>7,6</td>
<td>6,5</td>
</tr>
<tr>
<td>Variation – V, %</td>
<td></td>
<td>12,4</td>
<td>10,8</td>
<td>10,9</td>
<td>9,6</td>
</tr>
<tr>
<td>Range of dispersion</td>
<td></td>
<td>36-75</td>
<td>42-79</td>
<td>55-86</td>
<td>55-82</td>
</tr>
</tbody>
</table>

The results of investigating the negotiation skills show that the engineers of the experimental group mostly apply the analytical style (A) of negotiating, whereas the intuitive style (I) is practically not popular with them. The normative style (N) and the negotiating style based on facts (F) are used almost at the same level. The t-test was used for assessment whether the averages of different styles of negotiating are statistically different from each other. This analysis confirmed our conclusions stated before. We can conclude that in our research the intuitive style of negotiating was different from other three styles and the analytical style of negotiating was found different from other two styles as well. Difference between the analytical style of negotiating and style based on facts was found statistically not significant.

Every style of negotiating can be characterized by the main principle used in negotiating and different symptoms of human behaviour during the negotiations. A graphical view of the investigation results is presented in Fig. 2.

![Fig 2. Profile of negotiating styles related to engineers](image)

The negotiation style based on the facts is characterized by the main principle stating that facts are speaking for themselves. The main symptoms of behaviour are as follows: facts are presented in a natural way, keeping one’s word and reminding others about their previous statements (opinions), sharing previous experience in negotiations with other participants, classifying facts in negotiation, searching for evidence, keeping documentation of the statements made.

The intuitive style relies on the following main principle: imagination can solve any problem. The main symptoms of behaviour are: declaration of warm and enthusiastic confirmations, concentration on the whole situation or problem, precise definition of key (significant) elements, transference to future, creativity and taking advantage of imagination for analysing the situation, skipping from one topic to another, continuously presenting new projects and ideas.

The negotiation style based on standards (norms) relies on the following main principle: negotiations are aimed at effecting a transaction. Engineers of investigated group mostly use such negotiating style. The symptoms of behaviour are as follows: judging and evaluating the facts in accordance with a person’s hierarchy of values, showing approval or disapproval, expressing consent or disagreement, offering a transaction, suggesting a gift, making great demands, showing power, utilizing his/her position and authority, searching for compromise, concentrating on people, their reactions and attitudes, paying attention to the communication process and the situation in the group.

For the analytical style, the main principle is as follows: logic is leading (guiding) to right decisions. For this style, the key symptoms of behaviour are: searching for reasons, suggesting decisions and using them during the negotiations, making arguments for and against (pros and cons) when discussing personal and collective points of view, subdividing and grouping facts, analyzing every situation based on reasons and consequences, identifying the matching parts, putting things (objects) in logical order, utilizing linear calculations.

It can be assumed that any style of negotiating is applied neither too frequently or nor too seldom, if the results fall in the interval of 45 and 70 points. Every style of negotiating is used too rare if results in negotiating profile fall below 45 points. When results in this profile are exceeding 70 points then this style is used too frequently. In table 3 we can see distribution of frequencies for making use of every style of negotiating.

Table 3. Frequency of using different negotiation styles, %

<table>
<thead>
<tr>
<th>Style of negotiating</th>
<th>Used too rarely &lt;45</th>
<th>Used properly 45 – 70</th>
<th>Used too often &gt; 70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intuitive</td>
<td>1,5</td>
<td>85,4</td>
<td>13,1</td>
</tr>
<tr>
<td>Normative</td>
<td>0,1</td>
<td>68,5</td>
<td>31,4</td>
</tr>
<tr>
<td>Analytical</td>
<td>0,0</td>
<td>51,6</td>
<td>48,4</td>
</tr>
<tr>
<td>Based on facts</td>
<td>0,0</td>
<td>62,7</td>
<td>37,3</td>
</tr>
</tbody>
</table>

The analysis of results presented in Table 3 shows that all styles of negotiating are used either properly or too often. No one of the discussed four negotiating styles was used during negotiations too seldom. In many cases, styles of negotiating were used too frequently. The normative style (N) of negotiations is used by 31,4 % more often than is recommended by scientists. Other negotiating styles are also used too often, but the results...
do not exceed 50 % (the analytical style (A) is used too often in 48.4 % of cases, the style based on facts (F) is used too often in 37.3 % and the intuitive style (I) of negotiating is used too often in 13.1 % of cases). Some dependences can be observed when comparison the results of Tables 2 and 3 is made. When some style of negotiating is used more often then this style during negotiations is used less properly. This interesting finding of our research show to us that possibility of making mistakes is greater when some style of negotiating is used more often.

5. Conclusions

The results of the present investigation have revealed that the role of implementer is most acceptable for specialists of highway engineering enterprises as a psychological type and the role of plant is most unacceptable from this perspective. Other finding of the Lithuanian study was not so optimistic. Such important role as completer, which is necessary in solving anyone single problem or task was placed only on the sixth place.

The results obtained in studying the ability to negotiate show that the engineers of the investigated group mostly apply the analytical style of negotiation, whereas the intuitive style is least popular with them. The analytical style of negotiations is used by 48 % more often than is recommended by scientists.

The information collected in this research could be useful for the management of highway building enterprises as well as for the analysis of the roles played by the team members and, in some cases, for the formation of an ideal group to solve some relevant problems and to conduct negotiations.

References

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