The mechanism for assessing the personnel professional competencies at a loading and transport enterprise

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Abstract. The article describes the mechanism for assessing the personal and communicative professional competencies of personnel, corresponding to labor functions and the development strategy of a loading and transport enterprise. According to the results of the questionnaire of 21 respondents 44 meaningful competences were chosen from 257 proposed competencies. It is established that the use of the communicative competencies of personnel due to the emergence of a synergistic effect is more productive. The effectiveness of the work of the industrial control of labor protection department was defined within the range 58 - 98%. However, high production risks of incidents give rise to concerns, since during 23.7% of working time the labor functions are performed with violations of the requirements of professional standards. The results of the professional competences ranking are presented and distribution histograms on the importance of competences for improving labor productivity and reducing the risk of incidents in a loading and transport enterprise are constructed. The algorithm for sampling reduction by means of identification of the most significant competences is developed at loss of the minimum volume of the information. The probability of significant professional competencies for an enterprise exceeds 0.9.

1. Introduction

One of the main parameters that determine the personnel qualification is personal professional competence. These competencies are realized, as a rule, during performance of labor functions within the structure of production infrastructure elements, that is, services, sections, stations, storage facilities and other workplaces. The effectiveness of the interaction of personal competencies of individuals is generally assessed by the quantity and quality of the aggregate product created by the team with a minimal risk of incidents. In these conditions, the need for the development of personnel communicative competencies arises [1-4].

Under the personnel communicative competence the manager and worker should be understood as its certain elements, who are obliged to interact with other people when performing a separate or complex of labor functions within the prescribed modes of operation of the production facilities. The compulsory components of communicative competence are communicative abilities, knowledge, skills, motivation, as well as a synergetic effect when these qualities are jointly realized.

2. Methods of research

To develop a mechanism for assessing the personnel professional competencies at a loading and transport enterprise (LTE), various options for improving the personnel competence were considered,

for example, skills development while stimulating the growth of labor productivity or reducing the risk of incidents, hiring or firing when replacing workers with low competencies by employees with competences that increase competence. It is established that for each organization methods and mechanisms for increasing competence have their own peculiarities that are difficult to generalize and apply to other enterprises. Therefore, for LTE conditions, a mechanism has been developed to increase the personnel competence with a combination of personal and communicative competencies, depending on the forms of work organization and work functions.

Based on the analysis of the known methodological approaches and personnel management schemes [5-7], it is established that the use of communicative competences due to the appearance of a synergistic effect is more productive. To identify the links between personal and communicative competencies and assess their compliance with labor functions, complex full-scale studies were conducted according to the following scheme ("Delphi" method) [8]:

- development of a questionnaire form for expert assessment of the competencies importance by managers and line executors;
- development of the main provisions for the scoring system for assessing the importance weight of competencies;
- substantiation of the key indicators determining achievement of labor functions and LTE performance criteria;
- selection of experts;
- conducting an expert survey;
- processing the consistency of the results of expert assessment;
- development of a communicative competencies model based on the synthesis of individual competencies relevant to the corresponding labor functions.

3. Results and discussion

Prior to the survey, the experts were provided with the results of preliminary studies on the compliance of the activities of individual services and of LTE management with the requirements and opinion of the staff as a whole. Within the framework of the production control (PC) and labor protection (LP) services, a preliminary survey on the state of work safety was conducted.

For the expert survey two groups of experts were chosen: managers and line performers. The experts were asked to assess professional personal competencies according to the following indicators of influence: the risk of the incident occurrence, increase in labor productivity with the identification of target indicators, key competencies.

The list and types of competences were specified in the initial version of the questionnaire, but in the process of its discussion with experts new professional competences were added. Thus, only 257 competencies were included into the questionnaire. And only 44 competencies were identified as important by the experts. In total, an expert group of 21 people took part in the survey, who submitted 444 responses. After carrying out the expert evaluation in accordance with the questionnaire, the following results of the expert survey presented in figure 1 were obtained.
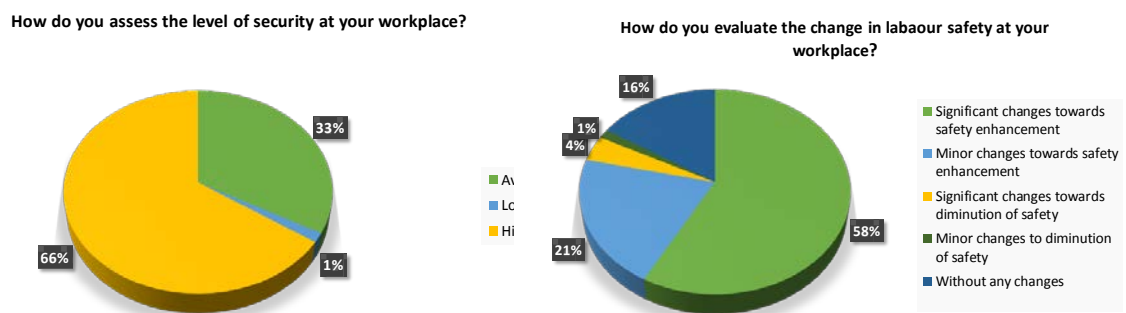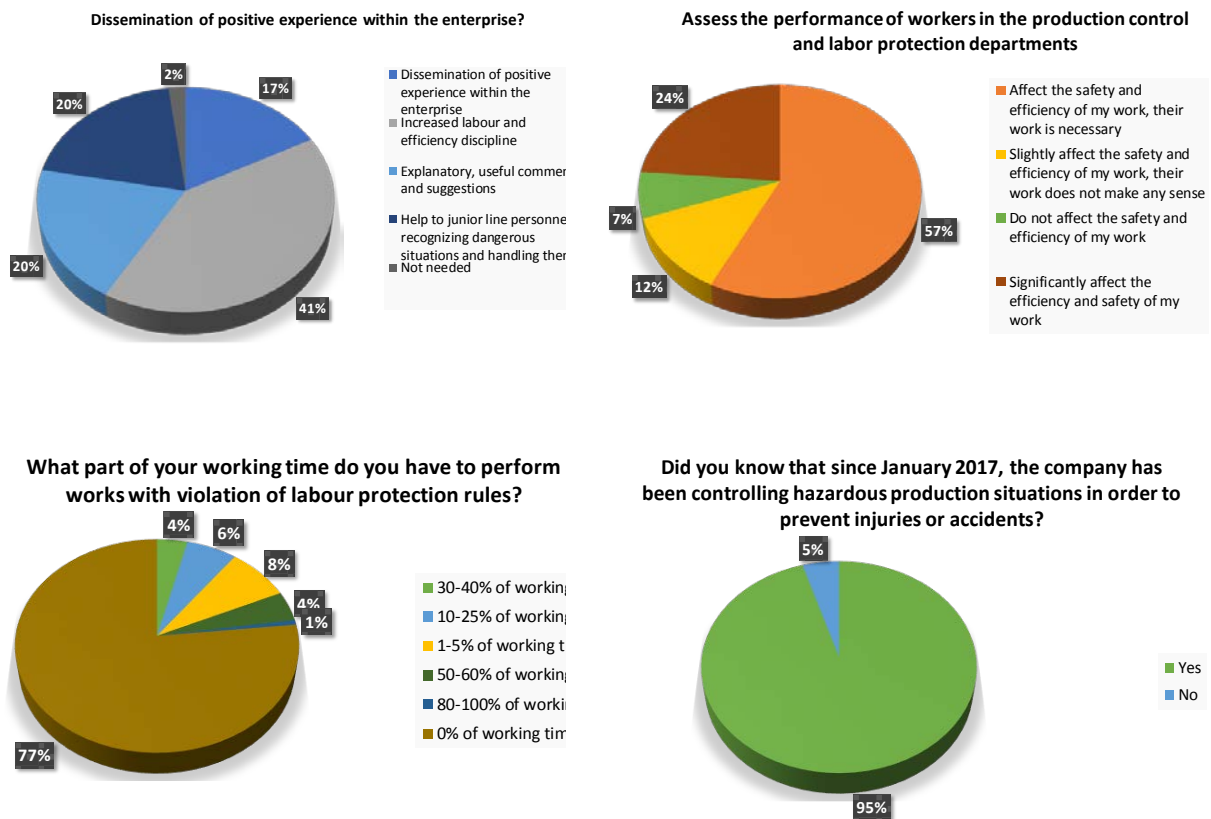
Figure 1. The results of statistical analysis of questionnaires on the effectiveness of industrial control and safety systems.

As follows from the diagrams given in figure 1, the performance of the production control (PC) and labor protection (LT) services is estimated by the staff positively within the range from 58 to 98%. However, high production risks of incidents give rise to concerns, since during 23.7% of working time the labor functions are performed with violations of the requirements of professional standards.

The probability of incidents exceeds 0.2, which is a high indicator. Obviously, the dependence of personal and communicative competencies on the level of individual, collective, social and technical and other risks should be revealed. For this purpose, in the memo for experts it is offered to highlight the positive or negative impact of each competence on the probability of incidents and the level of labor productivity during performance of labor functions.

To assess the competences importance, their ranking was carried out by the number of expert answers. Figure 2a shows the distribution histogram of the number of answers for each personal competence by the criterion of minimum incidents, and in figure 2b – by the criterion of labor productivity.

Given the large number of competencies and the range of their assessments, the task of reducing the sampling arises by highlighting the most significant competencies with the loss of a minimum amount of information. If we consider each competence as a random event, and the number of experts' assessments for each competence as the probability of this event, then we can find the law of distribution for these probabilities.

The scheme of changes in competencies assessments is close to the exponential distribution of the probability density [9-10], that is:

$$f(x) = a\mathrm{e}^{-\lambda x}, \tag{1}$$

where $f(x)$ is the distribution density of competencies assessments; a, λ – empirical coefficients; x – the ranking number of the competency in the graphs of figure 2.

To identify the significant competencies in the graphs of figure 2, the rule $3\sigma_x$ was used. On the graphs the boundary $3\sigma_x$ is indicated by a dashed line.

The results of the statistical analysis of competency assessments for the histograms shown in figure 2 are presented in table 1.

Table 1. Results of statistical analysis of competencies assessments.

Name of the indicator					Probability of meaningful competences $P_{3\sigma}$
mathematical expectation m_x	average quadratic deviation σ_x	$3\sigma_x$	empirical coefficients		
			a	λ	
3.00	4.69	14.07	13.00	0.18	0.920
3.00	3.98	11.94	14.67	0.22	0.913

According to the results obtained, it can be argued that the probability of selecting meaningful competencies from the general expert sampling exceeds 0.9. Therefore, the personal competencies are recommended for the development of a model of communicative competencies.
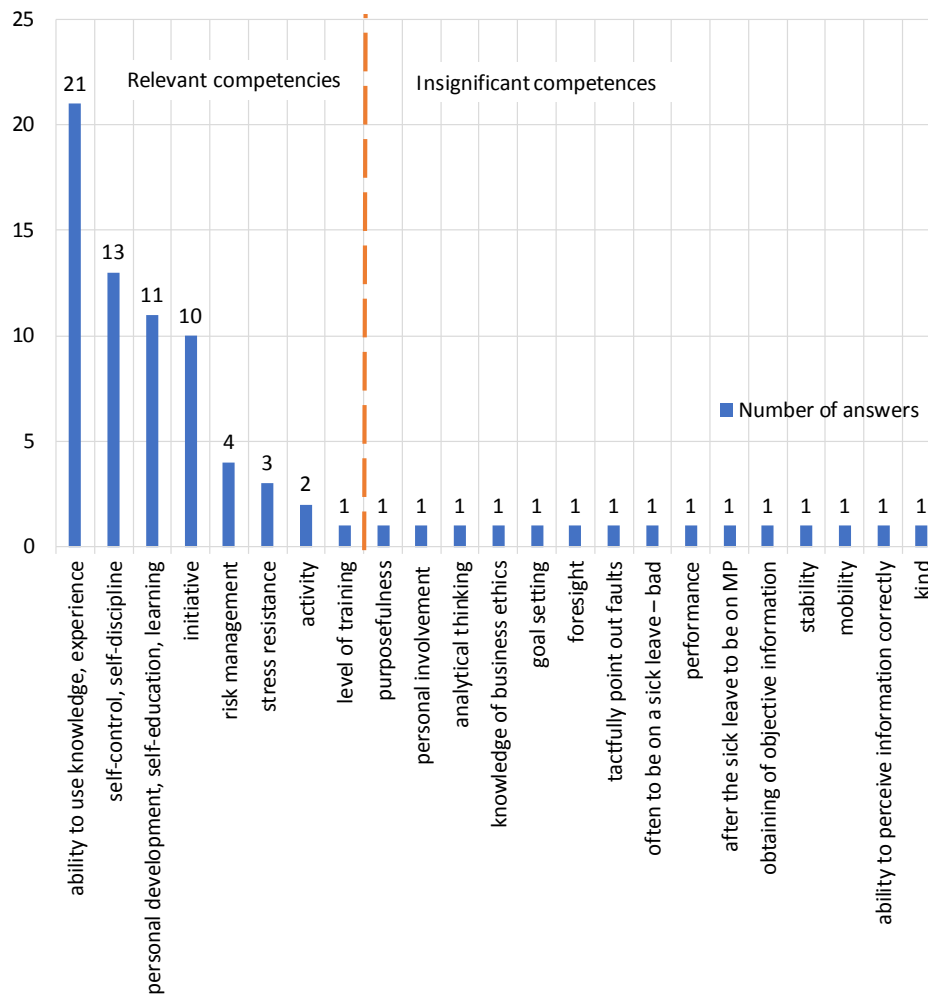
(a)
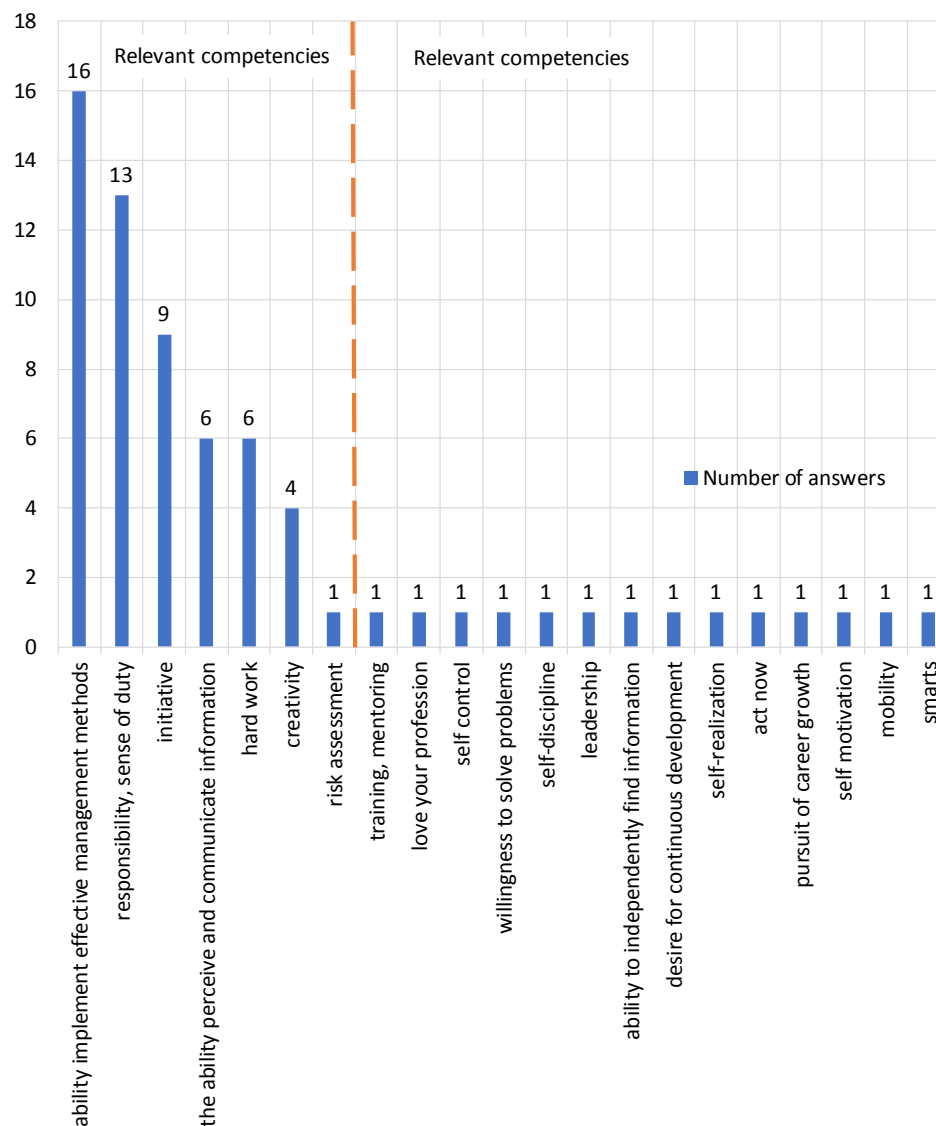
(b)

Figure 2. The scores distribution of personal professional competencies of the personnel: a – by the level of influence on the risk of incidents, $3\sigma_x = 14.07$; b – by level of influence on labor productivity $3\sigma_x = 11.94$.

4. Conclusion
A mechanism for assessing personal professional competencies, corresponding to labor functions and the development strategy at a loading and transport enterprise, has been developed. The recommendations for the use of personal professional competencies identified by ranking results during formation of communicative competences are given.

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