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PERFORMANCE MANAGEMENT OF THE MAINTENANCE STAFF ON THE BASIS OF CLASSIFICATION OF ITS SKILLS

ORGANIZACJA OCENY OSIĄGÓW PRACOWNIKÓW OBSŁUGI NA PODSTAWIE KLASYFIKACJI ICH UMIEJĘTNOŚCI

Abstract

The task of improving productivity is relevant to all spheres of human activity. One of the partial solution to this problem is to estimate the current staff and the prospects for its improvement.Assessment staff can be attributed to the most complex tasks due to the probabilistic nature of the processes occurring in human societies. It is known that in many industries different methods of assessment staff have developed. They are based on the desire to ensure the accuracy of estimates and the high predictive validity. In this paper, the authors of the methods of estimating repair and maintenance personnel on the basis of the classification of its skills. This technique is based on the authors' model estimates to reduce training time for young professionals to work with the tool, and the authors proposed an alternative method of evaluation of performance of works on servicing cars for young professionals. In addition, the authors assessed the possible use of automated equipment for storage and delivery of an instrument to reduce training time and increase productivity of repair and maintenance personnel.

Keywords: car service, working criteria, model of training workers

Streszczenie

Zadanie poprawy wydajności dotyczy wszystkich sfer ludzkiej działalności. Jednym z częściowych rozwiązań tego problemu jest ocena personelu i perspektywy jego rozwoju. Ocenę personelu można zaliczyć do najbardziej skomplikowanych zadań ze względu na probabilistyczny charakter procesów zachodzących w społecznościach ludzkich. Opracowano wiele różnych metod oceny personelu. Ich podstawowym celem jest zapewnienie dokładności estymacji i duża prawidłowość prognozowania. W artykule opisano metodę oceny pracowników naprawy i obsługi na podstawie klasyfikacji ich umiejętności. Metoda oparta jest na autorskim modelu estymacyjnym i ma na celu skrócenie czasu szkolenia młodych pracowników, uczących się posługiwania narzędziami. Autorzy artykułu zaproponowali alternatywną metodę oceny wyników pracy młodych pracowników obsługi samochodów. Ponadto autorzy ocenili możliwości zastosowania automatycznych urządzeń do magazynowania i wydawania przyrządów, co skraca czas szkolenia i zwiększa wydajność personelu naprawy i obsługi.

Słowa kluczowe: serwis samochodowy, kryteria pracy, model szkolenia pracowników

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Influence of qualification of the personnel on labor productivity including service of cars is difficult to overestimate. It influences the quality of carrying out of technological process service of cars, and for speed of its carrying out. The personnel estimation can be carried to complicated problems owing likelihood character of the processes occurring in human communities.

In many branches various methods of an estimation of the personnel are known. On their basis the aspiration to provide accuracy of an estimation and high prognostic validity is necessary. It is accepted to understand the degree of conformity of the results received by means of tools of an estimation such as validity, with indicators of real working efficiency.

The authors have developed a pricing model to reduce training time for young professionals to work with the tool. The mathematical form of record of model will have the following appearance:

Properties of function:

1) monotonously decreasing when each time speed of work increases,
2) its convex downwards when time of performance of work is reduced in the beginning faster,
3) time of performance of work when the young expert comes nearer to time of performance of operation by the skilled expert infinitely closes,
4) speed of reduction of time of performance of operation (between the young and skilled expert) is identical.

Function of time of the maintenance and repairs with increasing repair and maintenance staff (PMA) qualification is:

$$T(i) = \tau(1 + A\exp(-Bi)) \tag{1}$$

where:

τ – the maximum operation time (the time of an experienced worker),
A – the initial complexity of the operation (equivalent to primary education),
B – the speed of learning a particular specialist, depending on the individual,
i – number of operations.

Checking the properties of the function (to simplify the proof, we assume that i – a real number):

1) The function is decreasing if its derivative is negative:

$$T'(i) = -\tau BA\exp(-Bi) < 0 \tag{2}$$

2) The function is convex if its second derivative is positive:

$$T''(i) = \tau B^2 A\exp(-Bi) > 0 \tag{3}$$

3) It is obvious that the limit function exists:

$$\lim_{i\to\infty} T(i) = \lim_{i\to\infty} \tau(1 + A\exp(-Bi)) = \tau \tag{4}$$

4) Speed of learning is the first derivative, and the difference between the time of the operation between the young and experienced professionals. Then the ratio of these indices does not depend on:

$$\frac{T'(i)}{T(i)-\tau}=\frac{-\tau BA\exp(-Bi)}{\tau(1+A\exp(-Bi))-\tau}=-\tau B \tag{5}$$

To obtain the parameters A and B we need conduct the following transactions with statistics run-time operations in the training: $T(1)$, $T(2)$, $T(i)$.

We pass on this type of data to:

$$\left(\frac{T(i)}{\tau}-1\right)=\delta_i \tag{6}$$

where:

$T(i)$ – run-time intern i-th operation.

This value shows how much run-time intern works more than an experienced one. Then from (1), (2), we obtain:

$$\delta_i = A\exp(-Bi) \tag{7}$$

According to the parameters found by the method of least squares (OLS) [2]:

$$\ln\delta_i = \ln A - Bi \tag{8}$$

we set:

$$\ln A = a \tag{9}$$

$$\ln\delta_i = a - Bi \tag{10}$$

If ln(δ) is a linear function of a and B. Using the method of the least squares we find a, B. Then:

$$\hat{A} = \exp(a) \tag{11}$$

The young expert infinitely comes nearer to the professional. Therefore setting up the time of performance of operation in advance it is possible to calculate the training period.

For example, if T – required time at runtime operation, then solving the equation:

$$T(i) = T \tag{12}$$

$$T(i) = \tau(1+A\exp(-Bi)) = T \tag{13}$$

We obtain

$$\left(\frac{T}{\tau}-1\right) = A\exp(-Bi) \tag{14}$$

$$i=\frac{\ln\left(\dfrac{\dfrac{T(i)}{\tau}-1}{A}\right)}{-B}=\left[\frac{\ln\left(\dfrac{T(i)}{\tau}-1\right)-\ln A}{-B}\right] \tag{15}$$

How often a young professional approaches to a professional with a possible deviation of 5% – the maximum permissible deviation according to the standard rate for this experiment, which allows to estimate the rate of specialist training enough accurately.

$$i = \frac{\ln\left(\frac{0,05}{A}\right)}{-B} = \frac{-2,99 - \ln A}{-B} \tag{16}$$

On the basis of the dependence, the authors proposed the classification criterion for working on service vehicles – the complexity of developing of a new service operation (Fig. 1).

The development of a new operation – is to develop an employee in accordance with a certain dynamic stereotype to perform this work, as a result of repetitive rise a specialized skills specialist selects the best practices and methods of his implementation, which ensures that he works in the optimum (the project) with a minimum rate of physical and neural costs [3].

The complexity of developing a new service operation depends on the initial complexity of the operation (according to the basic knowledge and skills and vehicle maintenance and repair) and speed training operations (parameter equal to the rate of employee training, and characterizing the required number of transactions performed by an intern in order to achieve the specialist level) .

For qualitative assessment of the development of a new operation service the authors offer the following initial conditions for the classification.

The initial complexity of the operation:

Low – requires a performer of basic knowledge and skills; average complexity – requiring from the player-specific knowledge and skills;

High complexity – requiring deep knowledge of the performer of a car and experience in conducting such operations.

Speed training operations: Low speed, average speed, high speed. The complexity of the development of a new operation PMA. Low speed, average speed, high speed.

Accordingly, the combination of these two criteria corresponds to the various difficulties of mastering the new service operation.

By the method of assessment staff on the basis of mathematical models of learning repair work by the authors were determined numerical values for each element classification. Also, the authors of the enterprise conducted expert interviews to determine similar parameters (numerical values of bounds) according to experts. The data obtained by these two methods differ slightly.

The initial complexity of the operation:

- Low – requires a performer of basic knowledge and skills: 1 to 3,
- Medium-complexity requires a performer of specific knowledge and skills, from 3 to 7.5,
- High complexity – requiring deep knowledge of the performer of a car and experience in conducting such operations: more than 7.5.

Speed training operations:

- Low speed – from 0 to 0.02,
- Average speed – from 0.021 to 0.054,
- High speed – from 0.055 and above.

The evaluation of the operation we calculated (2):

$$S_o = \frac{K_n + V_o}{2} \tag{17}$$

where the complexity of the operation – is essential to the initial qualification.

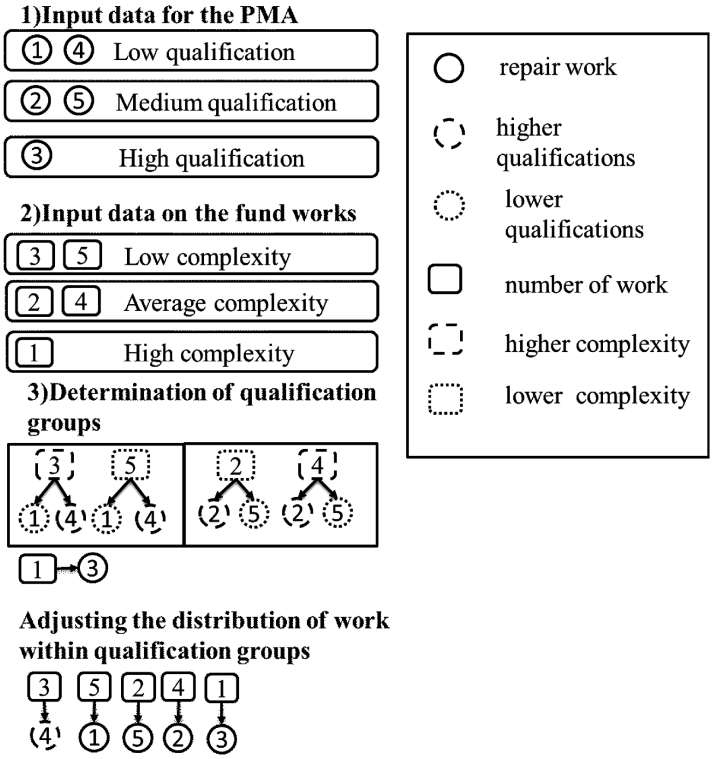

Fig. 1. Methodology for the classification of works of service complexity

Rys. 1. Metodologia klasyfikacji prac serwisowych

The data obtained shows the results in Table 1.

Table 1

The complexity of developing a new service operation

The complexity of the operation	The numerical limits
High	> 3.8
Medium	1.51–3.80
Low	< 1.5

Using the resulting classification of the development of new service and operations staff calculations based on a mathematical model of training maintenance workers to determine the list of operations PMA, which a person with certain skills will perform a set rate-watch, and determine the rate of development of new operations.

Conclusions:

1. The developed technique allows to estimate the complexity of the specific transaction service directly to a specific learning disability specialist criteria: initial complexity and speed of learning.
2. Using this technique allows you to specify the qualifications of each professional level, particularly beginners.
3. This scaling can be used as a tool for work-sharing service among professionals based on their skills and speed of execution of works PMA cars.
4. The proposed method allows us to apply a system of ranking experts as a tool for managing the workforce on the basis of personal qualities.

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