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Improving Staff Stimulation Systems: Causal-Consequence Approach

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Abstract*: *An effective system of staff motivation is one of the most significant factors in the competitiveness of modern organizations. In this regard, managers and personnel managers face an urgent task - to find ways to increase the motivation of the organization's personnel. To solve it, an in-depth scientific study of the problems of personnel motivation in market conditions is necessary to offer scientifically based recommendations and methodologies for building a motivation system, in particular using methods of mathematical modelling.

Index Terms*: *staff, personnel, motivation, stimulation, causal-consequence approach.

I. INTRODUCTION

An adequate system of staff motivation is one of the most significant factors in the competitiveness of modern organizations [1-3]. The critical task of management is to manage the resources at the disposal of the enterprise to obtain an optimal result. At present, the concept that the most crucial support of an enterprise is its personnel (often referred to as human capital) has become generally accepted, and in the light of this concept, the optimization of human resource management is of particular importance. One of the essential characteristics of social capital is its motivation to work, and the management of this indicator plays a crucial role in personnel management since it is generally accepted that there is a direct relationship between employee motivation and the efficiency of his work.Motivation is an activity that activates the collective of the enterprise and each worker and motivates them to work effectively for the fulfilment of goals. Motivation plays a leading role in labour productivity, in the effectiveness of the organization or enterprise as a whole. The problem of staff motivation is widely discussed today in scientific and journalistic literature [1-4]. However, attempts to adapt classical theories of motivation to modernity are not systematized in many ways, which makes it difficult to use technologies and methods of motivation in practice. At present, it is necessary that the entire staff of the organization act as a reliable team with a clear vision of the future, a clear idea of their meaning and motivation for independent actions to achieve their goals. Well-trained, motivated and organized staff determines the fate of the enterprise. After all, the human potential of an enterprise is the main competitive advantage. The scientific and practical results of writing this article together solve an essential scientific and practical task - improving the system of personnel motivation.

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II. MATHEMATICAL MODEL OF ESTIMATION OF THE EFFICIENCY OF INVESTMENTS IN STAFF TRAINING

Enterprise personnel can be classified according to various features. The personnel management system is classified in accordance with the participation of employees in the main activities of the enterprise. On this basis, the staff is divided into:

- production personnel are employees engaged directly in the production process and servicing them (including in research departments and laboratories, in warehouses, in security, in the management of the enterprise);
- non-productive personnel are employees of the non-productive sphere, whose objects are kept on the balance sheet of the enterprise but are not related to its primary activities (housing and communal services, children's and sanatorium organizations that belong to this enterprise).

To effectively use the potential of the company's personnel as one of the priority tasks of management, today there is the development of an effective system of motivation, which increases labour potential, and as a result of its growth, productivity increases, product quality and competitiveness of the enterprise as a whole. But one should not forget that motivation must be personalized. What can inspire one worker to work with higher productivity, in another can cause the opposite effect and lead to a decrease in creative potential.

An integral part of the learning process is the evaluation of the effect of learning. Most companies use the model proposed in 1959 by Donald Kirkpatrick [5]. The Kirkpatrick model includes four levels of assessment of learning outcomes (Fig. 1).

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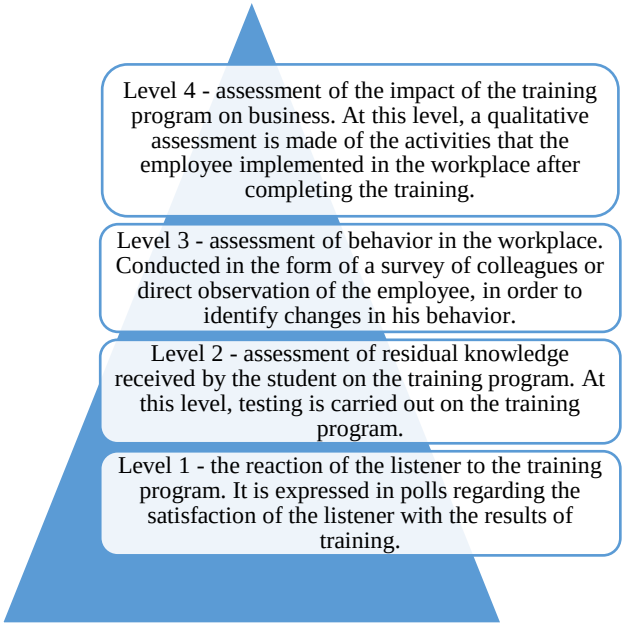

Fig. 1 Model estimates of the effect of training by Donald Kirkpatrick

Using the Kirkpatrick model to assess the effectiveness of learning, of course, helps to identify a positive learning outcome, but at the same time forms a stereotype of thinking associated with the perception of learning as an expensive budget item.There is still no unified theory of evaluating the effectiveness of investment in personnel.There is such a model of the process of personnel training in the framework of exactly this (functional) approach, that is, a function has been obtained that describes the response of the modelled object (personnel) to an external (training) effect [6; 7]:

$$b(t) = b_{max} - (b_{max} - b_{min}) * e^{-r*t} \quad (1)$$

where t– training time;

$b(t)$– current labour productivity of the group of personnel;

b_{max}– maximum value of labour productivity of the group of personnel;

b_{min}– minimum amount of labour productivity of the group of personnel;

r– "speed" of training of the group of staff ("indicator of training"). Such a model is quite general since it makes it possible to build a model for evaluating the effectiveness of investment in staff training, without being interested in the structure of the learning process, which obviously depends on the type of training program and other non-economic characteristics. To build this model, it is sufficient to determine the growth function of the investment in staff training (C_L) depending on the time of such training and the cost reduction function ($C\omega$) depending on the reduction in the group of personnel's work time ω.Suppose that the cost of implementing some training program grows linearly concerning the time of its operation TL, then

$$C_L = k_1 * T_L + C \quad (2)$$

where k_1– is the growth rate of costs with increasing learning time TL;

C – the charge of organizing the learning process, not dependent on TL.

The labour productivity of the personnel group working on the fulfilment of the scope of work ω, provided that the fulfilment of this volume is carried out periodically, and not once, can be defined as

$$b = \frac{\omega}{T_\omega} \quad (3)$$

where ω – the volume of work performed,

C – execution time amount of work ω

Then, taking into account the considered equation of the personnel training process model, the training time TL required to achieve a given level of labour productivity by a group of personnel is

$$T_L = -\frac{1}{r} * ln\frac{b_{max} - b(t)}{b_{max} - b_{min}} = -\frac{1}{r} * ln\frac{\frac{1}{T_{min}} - \frac{1}{T_\omega}}{\frac{1}{T_{min}} - \frac{1}{T_{max}}} = -\frac{1}{r} * ln\frac{1 - \frac{T_{min}}{T_\omega}}{1 - \frac{T_{min}}{T_{max}}} \quad (4)$$

where T_{min} – the minimum execution time of the work ω (corresponds to the maximum level of labour productivity b_{max});

T_{max} – the maximum execution time of the work ω (corresponds to the minimum level of labour productivity b_{min});

To assess the effectiveness of the training process should be approached from the standpoint of financial management and quantify the results of such investments. The solution to this problem was proposed in 1997 by Jack Phillips [8], who suggested adding four levels of the Kirkpatrick model with another degree, namely, to use the well-known financial indicator, the return on invested capital (ROI), to assess the personnel training process:

$$ROI = \frac{Financialresultfromtraining}{Trainingcosts} \quad (5)$$

With the outward simplicity of the formula, its calculation is hampered by the need to take into account all the costs of training, as well as to separate the effect from practice, from impacts that could arise as a result of the influence of other factors. In 2003, Jeff Moonen proposed simplified methods for calculating the return on investment SROI (Simplified Return-on-Investment) [9]. In particular, the calculation using non-financial indicators, the calculation of SROI on qualitative data and other methods.

III. CAUSAL-CONSEQUENCE RELATIONS IN THE PROMOTION OF LABOUR IN TERMS OF "NET PROFIT GROWTH".

In the literature [10-12], the idea is repeatedly emphasized that the need to stimulate (that is, to take into account the amount of labour and its remuneration) arises only in connection with the alienation of people from the goals and results of the assigned work, i.e. when the work is done by "outsiders". Stimulation is an additional payment of society (and enterprises) for the opportunity to achieve the goals of one group of people at the expense of the labour of another group of people (through the exploitation of employment). In the modern world, public opinion, the mentality of people, trade unions – everything is aimed at low labour standards and high pay. The interests of employers are opposite.

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The measure of a human resource (HR) is advisable to call the employee's labour potential and define it for a particular profession as its ability to perform a certain amount of work per working day. The unit of workload is proposed to adopt the standard labour hour (SLH) – the amount of work that an employee with typical intensity, who has an average market qualification of this professional group, will perform per hour of labour.

This definition allows us to obtain a formula for calculating the labour potential of an employee:

$$HR = k_q * k_i \bullet (Ts + Tad), (6)$$

where T_s – the standard duration of a working day (T_s = 8 hours);

T_{ad}– additional working hours;

k_i– the coefficient of labor intensity (k_i = 1 standard intensity);

k_q– the coefficient of qualification.

We give a conditional example. Suppose, in addition to 8 hours, the employee works 5 hours; the intensity factor of his labor is 1.5 (k_i = 1.5); the coefficient of qualification is 0.5 (k_q = 0.5). ThenthisemployeehasaHRequal 9.75 SLH.It should be borne in mind that the level of the human resource of a given employee determines only his ability to work. The actual amount of work done may differ significantly from the limit and depends on the level of its payment, which is strictly determined with the exact amount of work performed. The price of a human resource is equal to the market value of the SLH when performing work with an average labour intensity.

Consider the dependence of the volume of sales of labour by the employee on its price. The employer negotiates with the employee about the amount of human resource purchased and its rate with contractual terms. In practice, labour is allocated in the form of a salary for a part of a human resource. Award for the performance of work – above the duties on the salary. It should be borne in mind that staff at different prices can "sell" working time for the basic wage and working time for working for a bonus. Therefore, it is necessary to quantify the sales of a human resource from its price, provided that the "field of activity" is unlimited. An example of the dependence studied is shown in Fig.2. To build a graph in practice, you can set its specific points S_{min}– the minimum hourly rate that begins to interest the worker.

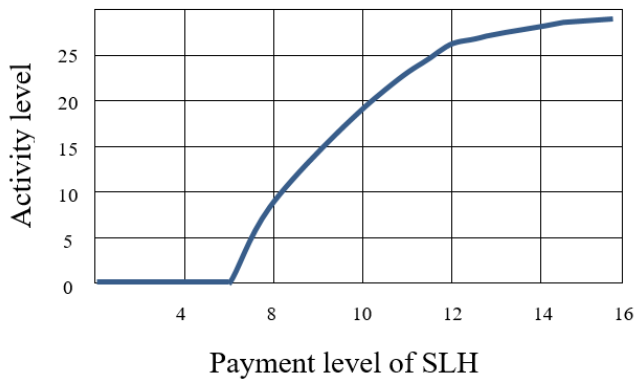

Fig. 2The dependence of the activity of the staff of the wage

We consider the integral indicator of net profit (NP) to be the leading indicator of the activity of the company's executive directorate, which is calculated through a set of indicators (profit growth during the period of the premium system, expansion of market share, development of new products, etc.). In developing specific provisions for stimulating managers, these indicators need to be further specified.

Denote the NP_{base}– the level of net profit of the enterprise in the base period. Then, in the period for which the level of additional remuneration is determined, its non-zero value will be obtained only if the condition of profit growth is higher than the standard level, i.e. $NP \geq NP_{base}$.

The magnitude of the increase in net profit (NPI), from which the remuneration is calculated, is defined as the difference $NIP = NP – NP_{base}$.

It should be noted that in practice, often the level of the NPI is taken to be zero, and then the calculated rate of profit growth is equal to the amount of profit received in the stimulation period under consideration, i.e. corresponding to the magnitude of the NP. The starting position for the search for the desired dependencies is the hypothesis that the level of net profit depends on the additional working hours of managers and (or) their high intensity of labour. As was shown above, this labour intensity depends on the level of expected remuneration, which is taken as part of the NPI. There is a chain of causal relationships, which has the form shown in Fig.3.

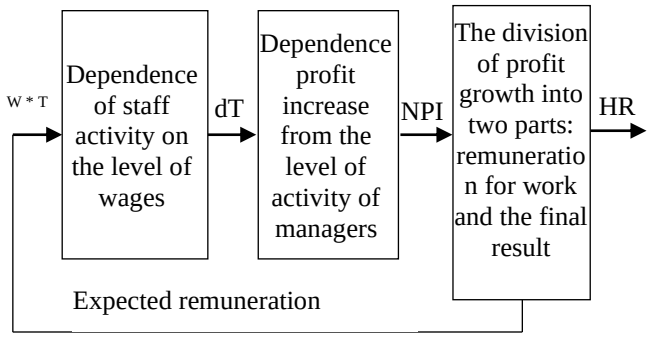

Fig.3The scheme of causal-consequence relations in the promotion of labour in terms of "net profit growth".

The schemein Figure 3 shows that for a quantitative description of the incentive process, it is necessary to determine the following relationships:

1. The dependence of the intensity of labour d on the level of hourly reward W, the expected group of managers. The mathematical expression of this dependence is as follows: d = f(W) (1)
2. The dependence of the estimated profit growth from the intensity of labour managers. Mathematically, this dependence will be written as:

$$NPI = \varphi\,(d, T, FCP) (7)$$

where FCP is the factors and conditions of production, i.e. prices, terms of product sales, availability of raw materials and supplies, equipment condition, etc.;

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T – the duration of the period of stimulation.

It should be noted that this dependence in the quantitative description of the incentive process occurs in two forms:

– in the way of the calculated relationship used by the board of directors when organizing the labour incentive system;– in the form of evaluating the dependence of the performers – a group of managers that is stimulated. This second form of relationship will be called the dependence of the expected increase in profits.

3. The amount of remuneration allocated for the remuneration of employees as part of the estimated net profit

$$W * T = Pr * NPI (8)$$

where Pr –profit share allocated to reward management employees according to contractual terms.Then the value of the final result of the enterprise has the following expression: FR = (1 – Pr) * NPI (4)It should be mentioned that when calculating the expected remuneration, managers estimate not only the value of the estimated net profit but also the degree of stability of the standard Pr, which in some cases can be adjusted by the board of directors or the meeting of shareholders in the event of urgent expenses.The application of the described approach to modelling work processes for a given dependence (1) and linear dependence of profit growth on the level of activity of managers for a particular production system gives the results presented in Table 1.

Table 1 Calculation of the stimulation system parameters (T = 500 hours)

Parameter	Values of remuneration shares Pr					
	0.0	0.05	0.10	0.15	0.20	0.25
Amount of remuneration	0.0	10.0	20.0	30.0	40.0	50.0
Estimated Executive Award	0	0	12.0	26.0	36.0	48.0
Total Award	0	0	5.0	13.0	18.0	24.0
Number of additional working hours	0	0	6.0	9.0	9.2	9.2
Extra Profit	0	0	120.0	180.0	184.0	184.0
Final result	0	0	114.0	153.0	147.2	138.0

Thus, the approach proposed to the calculation of incentive systems allows the selection of the optimal system parameters in the case when the functions "labour intensity – remuneration level" and the dependence of the company's profit on the intensity of labour of managers are set.

IV. CONCLUSION

The problems of the motivation of employees of enterprises remain at present very relevant, as the results of the activities of enterprises depend on properly developed systems of motivation, especially when introducing innovative technologies and scientific and technical progress into production.The development and practical application of new motivation systems directly in organizations (enterprises) make it possible to attract more highly qualified specialists who can manage both small and large teams, focusing mainly on individual motivation following the quantity and quality of labour.

The proposed optimization mathematical model allows not only to maximize the income from investments in staff training but also to evaluate their effectiveness. Also, the mathematical model of the incentive system enables you to select the optimal system parameters, if the dependence of the enterprise's profit on the intensity of the managers' work is set and the function "labour intensity – remuneration level" is set. Considered two aspects of staff incentives: staff training, in particular, performance assessment in investing in staff training and mathematical models of work processes, in particular, a measure of human resource assessment, can significantly improve the motivation of employees in the enterprise.

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