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## MODELLING THE FLEXIBLE SCHEDULES OF WORK OF INDUSTRIAL ENTERPRISES MANAGERS

The **subject** matter of the article is analyzing ways of using the potential capabilities of managers of industrial enterprises to implement high-performance activities as a factor of direct influence on the state and nature of the relationship between an employer and an employee. The **goal** is to build a model for flexible scheduling the work of enterprise managers that take into account the priority of solving production tasks in the subsystem of the personnel management of the decision support system for organizing the activities of an industrial enterprise. The **objectives** are to develop an economic and mathematical model that enables taking into account the rhythm of the fluctuations of the opportunities for achieving high results in the managerial activity and the activation of hidden potentials of managers by introducing flexible forms of managers' work into the scheduled plans of the production activities of industrial enterprises. The general scientific **methods** such as system analysis, structural analysis and specific network methods are used. The following **results** are obtained. The conceptual model of activating the efficiency of managers' production activities is suggested; the manager's activities are activated by minimizing the involvement of managers in performing production tasks when the values of the indicators of managers' potential capabilities are low, which objectively reduces the productivity of managerial work. At the same time, it is suggested to use the manager's capabilities at a time that coincides with the opportunities for high-performance work by adapting flexible schedules of managers' work to the requirements of the scheduled plans of an industrial enterprise. The integral indicator for assessing the impact of the rhythms of managers' activities on the state of their labour productivity is suggested for using in the models of organizing the activity of industrial enterprises. Recommendations are given to minimize the risks of disregarding the terms of employment contracts that are caused by the potential inability to obtain high indicators of managers' labour activities and to explain the advantages of using flexible schedules of managers' work to the representatives of an employer's personnel services. **Conclusions.** Modelling of flexible schedules of the work of managers of industrial enterprises enables correcting the work of managers at an enterprise taking into account the wave character of managers' readiness for highly productive work according to the positive feedback principle. The recommendations for calculating the integral indicator of assessing the impact of the rhythms of managers' activities on the state of productivity of their work are given. The obtained results can be used to determine more specifically the obligations of employers and managers as the parties of labour relations to agree on the duration, regularity, and the rhythm of managers' performance of their work-related obligations.

**Keywords:** enterprise, flexible work schedule, employee, model.

### Introduction

Managing an industrial enterprise in the market conditions of business environment generates a number of relations among the different subjects of management. The alignment of the interests of owners, employees, labour collective requires improving the mechanism of interaction as a way to achieve the goal and objectives of an enterprise. Business planning of the enterprise activities enables solving these problems but the plans are usually detailed and scheduled in order to overcome the complex nature of available contradictions among the subjects of management. At this stage, the opportunities of the enterprise related to the motives and incentives of the work activity are not fully taken into account; flexible forms of the work organization are often considered as a means of the intangible motivation of the personnel of the enterprise and less as a means of tangible minimization of the enterprise costs. Under the increase of the percentage of salary costs compared with tangible costs, this factor becomes sufficient to be considered in the scheduled plans of an industrial enterprise. First of all, the solution to these tasks depends on the organization of the activities of managers of different levels of management, whose activities should be a model of a high-performance work for all personnel of the enterprise.

### Analysis of literary sources and problem statement

Labour distribution in the process of organizing the interaction of members of the labour collective is the

driving force for improving the performance of the enterprise. The specialization of the members of the labour collective according to the tasks of management has always required the application of the systematic approach to the study of the content of managerial work and has been widely studied by foreign and Ukrainian scholars, in particular by V.G. Aliyev, L.V. Balabanova, O.M. Vinogradskaya, O.E. Kuzmin, L.E. Dovgan, A.A. Mazaraki, B.Z. Milner, S.V. Mocherny, P. Drucker, L. Seiwert [1, 2, 4, 5, 11, 12, 13, 14, 15, 16] and many others.

According to V.G. Aliyev's the scientific views [1, c. 249–261] the management work as an element of the organization of the production process requires the application of the systemic approach which is based on scientific principles. P. Drucker [2, p.289] considers that an effective manager should combine "useful time" to consolidate the time in order to spend it efficiently. R.A. Fathutdinov [3, c.458] thinks that the basic approach to the formation of a company manpower is standardizing the complexity of work for each group of staff and establishing the manpower norms that correspond to the rational organization of work. According to L. Seiwert [4, c.79, p.140], the system of planning the working time is an integral part of any manager's activity which should take into account the impact of the rhythms of human activity on the ability to work. A.A. Mazaraki [5, c.414-426] has come to the conclusion that selecting personnel for accomplishing target tasks is an integral part of the human resources management process which should be

carried out on the basis of the scientific organization of work.

It is clear that all the above views have differences but they have similar features: firstly, understanding the managerial labour as a component of the labour process which is connected with the transformation of information and requires the involvement of highly skilled specialists is a considerably complex process which uses much energy, memory and mental tension of the subject of management; secondly, promoting the implementation of economic and mathematical methods of management in general and economic and mathematical modelling the schedules of the personnel work of enterprises in particular; and thirdly, finding ways to optimize management costs.

This theoretical foundation enables identifying the problem of developing the models of highly effective organization of managers' work due to the introduction of the systematic approach to the process of selecting managers and making them perform the tasks scheduled by the plans for the development of enterprise activities.

### **Goals and objectives of the study**

The analysis of available approaches to minimizing management costs requires the study of the impact of a manager's personal state on the results of their work: the models for developing scheduled plans should take into account the managers' capability for high-performance work within the time determined by the plans of company activities. It is correctly reasoned that the groups of managers and individual managers are not equally prepared for completing production tasks, which poses a problem that should be solved.

Therefore, the company authorities should develop a concept for achieving the goal of the company activity, work out mechanisms necessary for its implementation, and bring the main talking points to the owners and members of the company labour collective. Thus, the goal of this study is to improve the mechanisms of the enterprise activities, to find opportunities for integrating flexible schedules of managers' work into the scheduled plans of enterprise activities, providing personnel units with tools for selecting staff and grouping managers within the units that ensure high performance of the enterprise. Therefore, the objectives of this study are to find ways to ensure the competitive advantages of an industrial enterprise, to maximize the profitability of its activities, to minimize management costs, to facilitate establishing a high-performance rhythm of managers' work.

### **Materials and methods of the study**

An important prerequisite for the profitability of an enterprise is the efficiency of management. Management as an activity bears the costs. First of all, this is the cost of management of an enterprise caused by executing managerial functions including administration costs (managing the activities of the enterprise authorities), financial management, risk management and so on.

Specific features of the types of managers' work are linked to the distribution of their work among various functions and processes of management (planning, organization, control, motivation, regulation) and the corresponding dominance of one function over another one in the daily work of a manager. Under rapid changes in food and financial markets, the markets of information and other services, low-productive labour costs of managers are the losses of an enterprise that reduces its profitability, as they are a part of products (services) that are produced for their own needs, a part of products that have not been or sold. And if excess costs for low-productive work of managers are direct for sold production, they are indirect for domestic and unsold products.

The issues that arise when production costs exceed the available norms in the main production process are usually clearly regulated by existing standards, regulations, orders, and so on, while insufficient attention is still paid to the problem of setting standards for costs of managers' work. In particular, this is due to the lack of the unified approach to determining the indicators of labour productivity of a manager. Thus, the indicators that depend on conscious changes of values of labour productivity indicators are studied more than the ones that depend on unconscious changes.

A manager as a human being cannot objectively maintain the consistently high level of productivity, so in order to avoid excessive costs, an enterprise should take into account the wave character of the fluctuations in the manager's capacity for productive labour including situations when the manager deliberately reduces the labour productivity and when it unintentionally decreases because of the manager's personal state. This problem is rather complicated, as the mechanism of regulating the activities of a manager linked with the conscious reduction of labour productivity by using relevant motivators is well known and more or less worked out but the mechanism that takes into account the effects of the rhythm of a manager's personal status still remains less studied as some specialists who work with personnel step back from the issue, since they consider that an enterprise can violate human rights that are declared in the European Convention for the Protection of Human Rights and Fundamental Freedoms [6], they also think that there are contradictions of manager's personal interests, labour collective interests and the interests of an enterprise. These arguments are vicious since the employment contract (agreement) is signed with the knowledge and acceptance of the use of intellectual, mental, physical, and other resources; and when its terms are being fulfilled, managers are obliged to maintain these terms in accordance with their obligations. A company as a party of the employment contract in its turn is obliged to use the work of a manager at a time when their potential capabilities are at the highest level. And if at a specific time moment, these capabilities lie below the required level, another manager whose potential capabilities lie within the specified limits should work. Managers can arrange different variants of work – each manager can work during a week, or they can work day by day or in

shifts, and so on, but the enterprise arranges only such a schedule of managers' work (managers' rotation) where, if all other conditions are equal, at every moment of working time the value of the integral indicator of the potential capabilities of a manager engaged in work lies within the norm, which makes the low-productive work impossible.

Such a schedule of managers' work will almost never coincide with the typical schedule of other employees' work but will allow the company to avoid excessive low-productive costs of their labour. The progressive experience of using flexible working schedules and the results obtained by enterprises due to the application of the latest methods of personnel work enable concluding that there is a dependence of the profitability of an enterprise on the quality of the managerial time use.

The algorithm of solving the tasks of developing flexible schedules of managers' work is based on the ideas of the scheduling theory with the use of network approach.

Let us take the following notations:

$j$  is the manager index,  $j = \overline{1, J_\gamma}$ ;  $i$  the index of activity direction,  $i = \overline{1, I}$ ;

$n$  is the task index,  $n = \overline{1, N(i)}$ ;  $\gamma$  is the index of managers group,  $\gamma = \overline{1, n}$ ;  $k$  is the index of available or created for implementing the  $i$ -th direction of an enterprise activity,  $k = \overline{1, K(i)}$ ;  $\lambda$  is the index of the  $j$ -th manager's resource that is needed to complete a set of tasks of the  $j$ -th activity direction,  $\lambda = \overline{1, \lambda_j}$ ;  $\phi$  is the index of the type of activity rhythm of the  $j$ -th manager,  $\phi = \overline{1, \omega}$ ;  $f_\phi$  are the values of the variable of the  $\phi$ -th rhythm of the manager activity;  $z^\gamma = \{(i, n)\}$  is a set of all tasks that can be solved by the  $\gamma$ -th group of managers;  $z_i$  is a set of all tasks of the  $i$ -th direction of activity;  $\tilde{z}^\gamma$  is a set of tasks assigned to the  $\gamma$ -th group of managers;  $z^{\gamma j}$  is a set of tasks that can be solved by the  $j$ -th manager;  $\bar{R}^{\gamma \lambda}$  is the maximum level of the  $\lambda$ -th resource of the  $\gamma$ -th group of managers;  $R^{\gamma \lambda}$  is the actual level of the  $\lambda$ -th resource of the  $\gamma$ -th group of managers;  $\tilde{R}^{\gamma \lambda}$  is the actual level of the  $\lambda$ -th resource of the  $\gamma$ -th group of managers;  $X_{in}^\gamma$  is the Boolean variable that is equal to 1, if the tasks  $(i, n)$  can be solved by the  $\gamma$ -th group of managers, and is equal to 0 if the tasks cannot be solved;  $X_{in}^{\gamma j}$  is the Boolean variable that is equal to 1, if the tasks  $(i, n)$  can be solved by the  $j$ -th manager of the  $\gamma$ -th group, and is equal to 0, if the tasks cannot be solved;  $\bar{t}_i$  is the time necessary for implementing the  $z_i^j$  set of tasks of the  $i$ -th activity direction;  $t_i$  is the moment of time when the  $z_i$ -set of tasks of the  $i$ -th activity direction are

completed;  $t^\gamma$  is the moment of time when the last task of the  $\tilde{z}^\gamma$  set of tasks is completed;  $\bar{t}^\gamma$  is the time necessary for implementing the  $\tilde{z}^\gamma$  set of tasks by the  $\gamma$ -th group;  $t_{in}^\gamma$  is the moment of time when the  $(i, n)$  task from the  $\tilde{z}^\gamma$  set of tasks is completed by the  $\gamma$ -th group;  $\bar{t}_{in}^\gamma$  is the time necessary for implementing the  $(i, n)$  task from the  $\tilde{z}^\gamma$  set of tasks by the  $\gamma$ -th group;  $t_{in}^{\gamma j}$  is the moment of time when the  $n$ -th task is completed by the  $j$ -th manager of the  $\gamma$ -th group;  $\bar{t}_{in}^{\gamma j}$  is the time necessary for implementing the  $n$ -th task by the  $j$ -th of the  $\gamma$ -th group;  $t_i^\gamma$  is the moment of time when the last task of the  $z_i^\gamma$  set of tasks is completed by the  $\gamma$ -th group of managers of the  $i$ -th activity direction;  $\bar{t}_i^\gamma$  is the time necessary for implementing – the  $z_i^\gamma$  set of tasks by the  $\gamma$ -th group of the  $i$ -th activity direction;  $T^{\gamma j}$  is the working time fund of the  $j$ -th manager of the  $\gamma$ -th group;  $T^\gamma$  is the working time fund of the  $\gamma$ -th group of managers;  $\alpha$  is the moment of time when the tasks are implemented,  $\alpha = \overline{1, T}$ ;  $T$  is the maximum possible time necessary for implementing the whole set of managerial tasks that are determined according to the plans for developing the activity of an enterprise;  $\tilde{z}^{\gamma \lambda}$  is a set of tasks of the  $\tilde{z}^\gamma$  set that corresponds to the  $\lambda$ -th resource necessary to solve the tasks of the  $z^\gamma$  set.

The scenario contains the following assumptions.

1. The network schedule of the complex of directions of an enterprise activity is set, where the vertices correspond to the events that determine the completion of the tasks of all directions of activity, i.e. the arcs which are included in each given vertex. The set of tasks of the direction of the enterprise activity is characterized by the time necessary for their implementation, which depends on the productivity of managers who solve the specified tasks.

2. Each activity direction includes the sets of task (groups of operations). The process diagram is given for implementing the tasks (procedures) for each direction.

3. The time necessary for solving the whole set of tasks of the complex of business activities is considered as an interval between the beginning of his first task and the end of the last one:

$$t_i = \max_{n=1, N(i)}^\Delta t_{in}^\gamma - \max_{n=1, N(i)} (t_{in}^\gamma - \bar{t}_{in}^\gamma).$$

The time necessary for solving the  $\gamma$ -th group of tasks is considered as the value

$$\bar{t}^\gamma = \max_{(i, n) \in \tilde{z}^\gamma}^\Delta \bar{t}_{in}^\gamma - \max_{(i, n) \in \tilde{z}^\gamma} (t_{in}^\gamma - \bar{t}_{in}^\gamma).$$

The time necessary for solving the task is determined by the labour productivity of the  $\gamma$ -th group that is solving this task:

$$\bar{t}_m^{\gamma} = \sum_{j=1}^{J_{\gamma}} \bar{t}_m^{\gamma j} X_{in}^{\gamma j}.$$

The Boolean variable  $X_{in}^{\gamma j}$  is equal to 1, if the manager of the  $j$ -th manager of the  $\gamma$ -th group has the positive  $\lambda$ -th resource  $R_{in}^{\lambda} = X_{in}^{\lambda} P^j F^j$  for implementing the  $(i, n)$  task, and is equal to 0, if the manager has no such a resource. Here,  $P^j$  is the predicted labour productivity of the  $j$ -th manager;  $F^j = \sum_{\phi=1}^{\omega} f_{\phi}$  is the integral indicator of the manager's potential capabilities (for  $\forall f_{\phi} \leq 0 \Rightarrow F^j = 0$ ). According to the law of the weakest link, the availability of the group resource depends on the availability of the positive  $\lambda$ -th resource of an individual manager of the  $\gamma$ -th group: variable  $X_{in}^{\lambda} = 1$ , if the  $j$ -th manager of the  $\gamma$ -th group can solve the  $(i, n)$  task and  $X_{in}^{\lambda} = 0$ , if they cannot solve it.

The task is characterized by the maximum and minimum time for its implementation:

$$\min_{j=1, J_{\gamma}} \bar{t}_m^{\gamma j} \leq t_m^{\gamma j} \leq \max_{j=1, J_{\gamma}} \bar{t}_m^{\gamma j}.$$

4. The manager can perform only one task and has a set of task types that they can solve.

5. Managers are grouped. A group is characterized by a set of task types  $z^{\gamma}$  it can solve, які вона може вирішувати,  $z^{\gamma} = \bigcup_{j=1}^{J_{\gamma}} z^{\gamma j}$ , and also by the general

working time fund  $T^{\gamma} = \sum_{j=1}^{J_{\gamma}} T^{\gamma j}$ .

Besides, a vector of resources is determined for each group of managers, that is the vector  $\bar{R}^{\gamma}$  with the length of  $\lambda_{\gamma} = \text{card } z^{\gamma}$ , where  $\lambda$  is the component that is equal to the  $\bar{R}^{\lambda}$  number of managers who can solve the  $\lambda$ -th task from the set  $z^{\gamma}$ . According to item 4  $\lambda_{\gamma} \geq J_{\gamma}$ ; at particular moments of time several or all  $\bar{R}^{\lambda}$  components change. There is the connection among the maximum, actual and determined number of resources at the moment of time:

$$\tilde{R}^{\lambda} \leq R^{\lambda} \leq \bar{R}^{\lambda}.$$

At the initial moment of time  $R^{\lambda} = \bar{R}^{\lambda}$ ,  $\tilde{R}^{\lambda} = 0$ .

Managers are grouped in such a way that  $z^{\gamma_1} \cap z^{\gamma_2} = 0$ ,  $\gamma_1 \neq \gamma_2$ , that is every group has a clearly determined range of tasks. This condition assigns the known set of tasks in each  $i$ -th direction of the enterprise

activity to each group of managers. Let us call each set a generalized task and assume that the implementation of generalized tasks is continuous. A generalized task comprises the groups of tasks that are related by the known sequence of execution (the technology of task solving).

6.  $\bar{R}^{\gamma}$  resources of any group of managers are sufficient at least for assigning any group of tasks, that is  $z^{\gamma} \geq \bar{z}^{\gamma} \geq z_i^{\gamma}$ .

Practically, it is reasonable to leave the resource of the group in the case when the  $j$ -th manager cannot perform the task due to unpredictable reasons. When this trouble happens, the group can take responsibility for relieving the consequences. The technique of its determining is the subject of a separate research.

7. The condition for solving the whole complex of tasks

$$\bigcup_{i=1}^I z_i \leq \bigcup_{j=1}^J z^j.$$

The mathematical model of the task of developing the flexible schedule of managers' work is as follows:

$$\bar{t}_m^{\gamma j} \geq t_m^{\gamma j} + \max_{\alpha \in U_{in}} t_{i\alpha}^{\gamma j}, \quad i = \overline{1, I}, \quad n = \overline{1, N(i)}, \quad j = \overline{1, J_{\gamma}};$$

$$\max_{\alpha, \gamma, j} t_{i\alpha}^{\gamma j} \leq T_i, \quad i = \overline{1, I};$$

$$\min_{j=1, J_{\gamma}} \bar{t}_m^{\gamma j} \leq \max_{j=1, J_{\gamma}} \bar{t}_m^{\gamma j}, \quad i = \overline{1, I}, \quad n = \overline{1, N(i)};$$

$$\sum_{i=1}^I \sum_{n=1}^{N(i)} \bar{t}_m^{\gamma j} X_{in}^{\gamma j} \leq T^{\gamma j}, \quad j = \overline{1, J_{\gamma}};$$

$$\tilde{R}^{\lambda} \leq \bar{R}^{\lambda}, \quad \lambda = \overline{1, \lambda_j};$$

$$\bar{t}_m^{\gamma j} = \sum_{j=1}^{J_{\gamma}} \bar{t}_m^{\gamma j} X_{in}^{\gamma j}, \quad i = \overline{1, I}, \quad j = \overline{1, J_{\gamma}}, \quad n = \overline{1, N(i)};$$

$$\bar{t}^{\gamma} = \max_{z^{\gamma}} t_m^{\gamma j} - \min_{z^{\gamma}} (t_m^{\gamma j} - \bar{t}_m^{\gamma j});$$

$$\bar{t}^{\gamma} \rightarrow \min.$$

The value  $T_i$  can be given; otherwise, it is considered that  $T_i = T$ . The values  $t_{in}^{\gamma}, t_{in}^{\gamma j}, X_{in}^{\gamma j}$  are unknown. The values  $\bar{T}^{\gamma j}, \bar{R}^{\lambda}, \bar{t}_m^{\gamma j}$  are given. Besides, a set of tasks that are preliminary according to the network schedule is considered known at all times.

The tasks of developing the flexible schedule are solved in two steps: firstly, a set of tasks is assigned to the groups of managers, then the tasks are fixed by the group managers. The algorithm of developing the flexible schedule of the  $\gamma$ -th group of managers is suggested.

1. Minimum and maximum time if given for implementing each task from  $z_i^{\gamma}$  with no regard for the managers' load.

2. The earliest moments of the implementation of all tasks are determined. At the initial moment of time the step value  $\theta$  of the simulated time during which the assignment of tasks does not change  $\theta^0 = 0$ .

3. The counter of the simulated time  $\alpha$  that is equal to the least time of task implementation is the following:  $\alpha = 0$ .

4. The extended front of tasks  $\mathfrak{T}_{\theta^\alpha}$  is developed. Initially, it comprises all tasks that start at the moment of time  $\alpha = 0$ .

5. If  $\mathfrak{T}_{\theta^\alpha} = 0$ , see item 11.

6. Generalized reserves of time for each task  $\tau(\mathfrak{T}_{\theta^\alpha}, \theta^\alpha)$  are determined.

7. The classes of tasks  $Q_\beta$  are developed according to the increase of the generalized reserves of time

$$\mathfrak{T}_{\theta^\alpha} = \bigcup_{\beta} Q_\beta.$$

8. Let us take in order the classes of tasks  $Q_\beta$  and assign the tasks for implementing whenever possible: if two conditions are met simultaneously

$$R_{in}^{j^\lambda} > 0 \text{ та } T^{\gamma j} \geq \bar{t}_{in}^{\gamma j}$$

the task is assigned to the manager who can execute it for the shortest time.

If  $R_{in}^{j^\lambda} = 0$ , the task is marked and put in the front of tasks for the following moment of time  $\mathfrak{T}_{\theta^{\alpha+1}}$ . If there is no manager who has the necessary time fund, the algorithm breaks and a message is sent that the fund of the working time lacks for the  $(i, n)$ -th task and the responsible person uses the heuristic procedure of appointing an executor from outsourcing managers or involves a new manager according to the criterion of economic feasibility of the decision made. When all tasks of the  $Q_\beta$  th class are considered, the  $\beta = \beta + 1$  group of tasks is considered as long as all the front of the task is not considered. A manager is appointed for implementing each task.

9. For each task

$$\alpha_{in}^{\gamma j'} = \min \frac{\bar{t}_{in}^{\gamma j'}}{\bar{t}_{in}^{\gamma j}}$$

is calculated.

For each  $Q_\beta$  th class of tasks

$$\bar{\alpha}_\beta = \min_{Q_\beta} \alpha_{in}^{\gamma j}; \alpha_\beta = \max_{Q_\beta} \alpha_{in}^{\gamma j};$$

is calculated.

Each  $Q_\beta$  class is considered as a set of  $Q_\beta^1$  assigned tasks  $\alpha_{in}^{\gamma j} = 1$ ; a set of  $Q_\beta^2$  tasks from  $0 < \alpha_{in}^{\gamma j} < 1$ ; a set of  $Q_\beta^3$  tasks from  $\alpha_{in}^{\gamma j} = 0$ , that have not been assigned:

$$Q_\beta = Q_\beta^1 \cup Q_\beta^2 \cup Q_\beta^3.$$

10. Let us consider the time reserves for implementing the tasks of  $\mathfrak{T}_{\theta^\alpha}$  front within such short period of time that  $\mathfrak{T}_{\theta^\alpha} = \mathfrak{T}_{\theta^j}$ . Let us calculate  $\theta_{in}^{j^\lambda}$ , that is the earliest moment of time of completion of the front of the  $\mathfrak{T}_{\theta^\alpha}$  tasks as well as the earliest moment of time of probable restoration of the maximum level of resources  $R_{in}^{j^\lambda}$ . Let us restore the maximum level of resources and calculate the values  $T^{\gamma j} = T^{\gamma j} - \theta^\alpha$  for all managers who completed the tasks within the time from  $\theta^\alpha$  to  $\theta^{\alpha+1}$ . Let us move to item 4.

11. All the tasks are completed for the time  $\theta^\alpha$ . If  $\theta^\alpha > T$ , the message which says that there is no solution is created. Let us develop the file where the time of beginning, execution duration and a responsible manager are determined for each task, that is the file where the codes of tasks and the corresponding moment of work beginning and end match up the code of the manager.

### The results of the research

The analysis of the concepts of modelling managers' schedules which take into account the state of potential managers' capability to perform scheduled tasks makes it possible to state that accounting the rhythm of changes in managerial capabilities objectively contributes to reducing management costs. The integral index of such impact should be calculated according to the formula:

$$F^j = \sum_{\phi=1}^{\omega} f_\phi; f_\phi = \sin \frac{2\pi(365y + v + o)}{p_\phi} 100\%,$$

where  $\omega$  is the number of rhythms of a manager's activity the calculation bases on,  $\omega = 1, 2, 3$  (while making a decision, another number of the types of a manager's activity can be used as well as the correction of rhythms duration depending on personal capabilities of a manager);  $\phi$  is the type of the rhythms of a manager's activity (for intellectual  $\phi = 1$ , the values  $p_1 = 33$  days; for emotional  $\phi = 2$ , the values  $p_2 = 28$  days; for physical  $\phi = 3$ , the values  $p_3 = 23$  days;  $o$  is a number of days that passed from the day of birth till the date of calculation (less than a year, as a rule);  $v$  is the number of leap years on the day of calculation that have passed since the day of birth;  $y$  is a number of fully spent years on the date of calculation;  $\pi$  is a number that is approximately equal to 3,14159265359.

For example, for a 46-year-old person born on April 30, 1967  $f_1 = 45,82\%$ ;  $f_2 = 62,35\%$ ;  $f_3 = -52,96\%$  on 05.09.2013.

It should be mentioned that the integral index of potential capabilities of a group of managers calculated by the formula  $F^\gamma = \sum_{j=1}^{J_\gamma} F^j$  does not take into account the

synergistic effect of the mutual influence of group managers who work in direct contact and the factor of collective influence needs further investigation.

The probabilities of non-standard managerial work, remote work, personification and individualization of work modes at a modern enterprise prove that the organization of a manager's work according to the typical schedule of an enterprise should be regarded as an event that does not contribute to minimizing management costs, and vice versa, the organization of a manager's schedule greatly depends on the costs necessary for managerial work but not on the variable work schedule of the main production personnel and enables minimizes management costs and contributes to the growth of the profitability of the enterprise activity.

The obtained results are proved by scientific conclusions made by other scientists. Thus, the scientific research conducted by O. V. Zhadan enabled making the conclusion that "in a globalized world, the diversification of employment relations becomes an important competitive advantage" [7]. N. V. Kozhukhova, A. S. Molodova noted [8] that "experience shows that the optimization of the salary budget and the losses of working time due to introducing flexible work schedules allow the enterprise to save; the effect obtained as a result of the optimization can be compared with the result of reducing personnel by 15-20%". Considering the equal share of the mode of working time use, Z. Malyshevskaya [9] noted that "in order to introduce one of the working time modes within the labour legal relations that arise among the subjects of the labour law on the basis of an employment contract concerning the use of a wage worker, it is necessary to consider and discuss the feasibility of its introduction taking into account the specifics of the industry in which the company operates". I.A. Vetukhova [10] detailed the use of flexible schedules for various categories of workers and concluded that "the purpose of the introduction of such a mode lies in the fact that it should promote the appropriate organization of production, increase its efficiency, provide labour discipline and the best combination of economic, social and personal interests of workers and an enterprise". Consequently, solving the problems of the implementation of various modes of operation of the enterprise personnel lies in the capability of the management to take into account the request for developing the adaptive system of personnel support for the activities of a modern industrial enterprise.

In order to achieve the equivalence of the state of contract relations between the manager and the company, systematic studies of the compliance of the impact of the estimated and actual rhythms on the results of the labour activity should be conducted.

### The results of the research

The analysis of the concepts of modelling managers' schedules which take into account the state of potential managers' capability to perform scheduled tasks makes it possible to state that accounting the rhythm of changes in managerial capabilities objectively contributes to reducing

management costs. The integral index of such impact should be calculated according to the formula:

$$F^j = \sum_{\phi=1}^{\omega} f_{\phi} ; f_{\phi} = \sin \frac{2\pi(365y + v + o)}{p_{\phi}} 100\% ,$$

where  $\omega$  is the number of rhythms of a manager's activity the calculation bases on,  $\omega=1,2,3$  (while making a decision, another number of the types of a manager's activity can be used as well as the correction of rhythms duration depending on personal capabilities of a manager);  $\phi$  is the type of the rhythms of a manager's activity (for intellectual  $\phi=1$ , the values  $p_1=33$  days; for emotional,  $\phi=2$ , the values  $p_2=28$  days; for physical  $\phi=3$ , the values  $p_3=23$  days;  $o$  is a number of days that passed from the day of birth till the date of calculation (less than a year, as a rule);  $v$  is the number of leap years on the day of calculation that have passed since the day of birth;  $y$  is a number of fully spent years on the date of calculation;  $\pi$  is a number that is approximately equal to 3,14159265359.

For example, for a 46-year-old person born on April 30, 1967  $f_1=45,82\%$ ;  $f_2=62,35\%$ ;  $f_3=-52,96\%$  on 05.09.2013.

It should be mentioned that the integral index of potential capabilities of a group of managers calculated by

the formula  $F^{\gamma} = \sum_{j=1}^{J_{\gamma}} F^j$  does not take into account the

synergistic effect of the mutual influence of group managers who work in direct contact and the factor of collective influence needs further investigation.

The probabilities of non-standard managerial work, remote work, personification and individualization of work modes at a modern enterprise prove that the organization of a manager's work according to the typical schedule of an enterprise should be regarded as an event that does not contribute to minimizing management costs, and vice versa, the organization of a manager's schedule greatly depends on the costs necessary for managerial work but not on the variable work schedule of the main production personnel and enables minimizes management costs and contributes to the growth of the profitability of the enterprise activity.

The obtained results are proved by scientific conclusions made by other scientists. Thus, the scientific research conducted by O. V. Zhadan enabled making the conclusion that "in a globalized world, the diversification of employment relations becomes an important competitive advantage" [7]. N. V. Kozhukhova, A.S. Molodova noted [8] that "experience shows that the optimization of the salary budget and the losses of working time due to introducing flexible work schedules allow the enterprise to save; the effect obtained as a result of the optimization can be compared with the result of reducing personnel by 15-20%". Considering the equal share of the mode of working time use, Z. Malyshevskaya [9] noted that "in order to introduce one of the working time modes within the labour legal relations that arise among the subjects of the labour law on the basis of an

employment contract concerning the use of a wage worker, it is necessary to consider and discuss the feasibility of its introduction taking into account the specifics of the industry in which the company operates". I.A. Vetukhova [10] detailed the use of flexible schedules for various categories of workers and concluded that "the purpose of the introduction of such a mode lies in the fact that it should promote the appropriate organization of production, increase its efficiency, provide labour discipline and the best combination of economic, social and personal interests of workers and an enterprise". Consequently, solving the problems of the implementation of various modes of operation of the enterprise personnel lies in the capability of the management to take into account the request for developing the adaptive system of personnel support for the activities of a modern industrial enterprise.

In order to achieve the equivalence of the state of contract relations between the manager and the company, systematic studies of the compliance of the impact of the estimated and actual rhythms on the results of the labour activity should be conducted.

### Results discussion

The suggested approach to the integration of flexible plans of managers' activities restricts the activities of an enterprise by the requirements of the clear quantitative justification of their reasonability and limits of adapting the scheduled plans of activities in accordance with the results of economic and mathematical calculations. The need to take into account the requirements of the results of applying scientifically-based approaches requires efforts within the enterprise that could enable using opportunities for increasing the profitability of enterprises to the full extent.

It should be noted that not only the regulatory requirements of the current legislation that regard, for

example, the duration of the working day at a six-day working week which should not exceed 7 hours a day (part 2 of article 52 of the Labor Code), 40 working hours per week (article 50 of the Labor Code), and other regulators of the company's capabilities act as an external limiting factor for introducing flexible, adaptive systems of personnel support of the activities of enterprises but also the unpreparedness of the internal environment to innovative types of labour relations, attempts to frame them within the standard employment which do not help minimize the cost of managerial labour.

The assessment of fluctuations in the group productivity of managers in different departments of the organizational structure of an enterprise remains unsolved as well as their impact on the final result of the activities of the whole labour collective of an industrial enterprise.

The problem of determining the basis and assessing the excessive costs of managerial work which determine the necessity of particular personnel changes and the improvement of the system of work organization in general also remains unresolved.

### Conclusions

This article considers the issues of correcting the schedules of managers' work at the enterprise taking into account the wave character of the state of managers' preparedness for high-performance work.

The use of the integral indicator of the impact of managers' rhythms on their performance is suggested.

Industrial enterprises are invited to use the model of organization of flexible schedules of managers of industrial enterprises.

Managers are invited to study the adequacy of the impact of estimated and actual rhythms on the results of work.

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### МОДЕЛЮВАННЯ ГНУЧКИХ ГРАФІКІВ РОБОТИ МЕНЕДЖЕРІВ ПРОМИСЛОВИХ ПІДПРИЄМСТВ

**Предметом** дослідження в статті є аналіз шляхів використання потенційних можливостей менеджерів промислових підприємств до здійснення високопродуктивної діяльності як фактору безпосереднього впливу на стан та характер відносин між роботодавцем та найманим працівником. **Мета** – побудова моделі формування гнучких графіків роботи менеджерів підприємств, які враховують пріоритетність вирішення виробничих завдань, в підсистемі кадрового управління системи прийняття рішень з організації діяльності промислового підприємства. **Завдання:** розробити економіко-математичну модель, яка дозволяє враховувати ритмічність коливань можливостей досягнення високих результатів менеджерської діяльності та активізації скритих потенціалів менеджерів шляхом широкого впровадження гнучких форм роботи менеджерів в план-графіки виробничої діяльності промислових підприємств. Використовуються загальнонаукові методи системного, структурного аналізу і специфічні мережеві методи. Отримано такі **результати**. У статті надана концептуальна модель активізації результативності виробничої діяльності менеджерів за рахунок мінімізації задіяння менеджера до виконання виробничих завдань під час низьких значень показників потенційних можливостей менеджера, які об'єктивно знижують продуктивність менеджерської праці. Водночас, запропоновано використання можливостей менеджера в такий час, який співпадає з потенційними можливостями до високопродуктивної праці шляхом адаптації гнучких графіків роботи менеджерів до вимог план-графіків діяльності промислового підприємства. Рекомендовано застосування в моделях організації діяльності промислових підприємств інтегрального показника оцінки впливу ритмів діяльності менеджерів на стан продуктивності їх праці. Надані рекомендації з мінімізації ризиків невиконання умов трудових договорів з причин потенційної неможливості отримання високих показників трудової діяльності з боку менеджерів та роз'яснення переваг застосування гнучких графіків роботи менеджерів для представників кадрових служб роботодавця. **Висновки.** Моделювання гнучких графіків роботи менеджерів промислових підприємств дозволяє коригувати роботу менеджерів на підприємстві з урахуванням хвилюваних особливостей станів готовності менеджерів до високопродуктивної праці за принципом позитивного зворотного зв'язку. Надано рекомендації з обчислення інтегрального показника оцінки впливу ритмів діяльності менеджерів на стан продуктивності їх праці. Отримані результати можуть бути використані для більш конкретного визначення зобов'язань роботодавців та менеджерів як сторін трудових відносин в частині узгодження питань тривалості, періодичності, ритмічності виконання менеджерами власних трудових зобов'язань.

**Ключові слова:** підприємство, гнучкий графік роботи, працівник, модель.

### МОДЕЛИРОВАНИЕ ГИБКИХ ГРАФИКОВ РАБОТЫ МЕНЕДЖЕРОВ ПРОМЫШЛЕННЫХ ПРЕДПРИЯТИЙ

**Предметом** исследования в статье является анализ путей использования потенциальных возможностей менеджеров промышленных предприятий к осуществлению высокопроизводительной деятельности как фактора непосредственного влияния на состояние и характер отношений между работодателем и наемным работником. **Цель** – построение модели формирования гибких графиков работы менеджеров предприятий, учитывающих приоритетность решения производственных задач, в подсистеме кадрового управления системы принятия решений по организации деятельности промышленного предприятия. **Задача:** разработать экономико-математическую модель, которая позволяет учитывать ритмичность колебаний возможностей достижения высоких результатов менеджерской деятельности и активизации скрытых потенциалов менеджеров путем широкого внедрения гибких форм работы менеджеров в план-графики производственной деятельности промышленных предприятий. Используются общенаучные методы системного, структурного анализа и

специфические сетевые методы. Получены следующие **результаты**. В статье предоставлена концептуальная модель активизации результативности производственной деятельности менеджеров за счет минимизации задействования менеджера для выполнения производственных задач при низких значениях показателей потенциальных возможностей менеджера, которые объективно снижают производительность менеджерского труда. В то же время, предложено использование возможностей менеджера в такое время, которое совпадает с возможностями к высокопроизводительному труду путем адаптации гибких графиков работы менеджеров с требованиями план-графиков деятельности промышленного предприятия. Рекомендовано применение в моделях организации деятельности промышленных предприятий использование интегрального показателя оценки влияния ритмов деятельности менеджеров на состояние производительности их труда. Даны рекомендации по минимизации рисков невыполнения условий трудовых договоров из причин потенциальной невозможности получения высоких показателей трудовой деятельности со стороны менеджеров и разъяснения преимуществ применения гибких графиков работы менеджеров для представителей кадровых служб работодателя. **Выводы.** Моделирование гибких графиков работы менеджеров промышленных предприятий позволяет корректировать работу менеджеров на предприятии с учетом волновых особенностей состояний готовности менеджеров к высокопроизводительному труду по принципу положительной обратной связи. Даны рекомендации по исчислению интегрального показателя оценки влияния ритмов деятельности менеджеров на состояние производительности их труда. Полученные результаты могут быть использованы для более конкретного определения обязательств работодателей и менеджеров как сторон трудовых отношений в части согласования вопросов продолжительности, периодичности, ритмичности выполнения менеджерами своих трудовых обязательств.

**Ключевые слова:** предприятие, гибкий график работы, работник, модель.

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