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Technology of project time management

Tecnología de gestión del tiempo del proyecto

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Content

ABSTRACT:

The article describes the technology of project time management under conditions of strict time constraints. The classification of the organization's employees is given within the framework of the article, assuming such types as: generator; operator; office drones; organizer, freelancer. Various conditions for project implementation are considered, which present the following situations: tasks are distributed only between department employees, with each work performed only by a specific employee; tasks are distributed only between employees of the department, but you can apply the method of teamwork on a specific task; tasks are distributed among employees, and there is also the opportunity to reduce the time of routine work due to the creativity of the generator; use all the possible levers of project management – the generator, freelancers, the joint work of several employees on one task. Based on an assessment of the feasibility of implementing all project tasks, the effect of differences in the different employees' performance during the execution of individual tasks is shown. The levers of project time management are determined – joint work of employees on separate stages, attraction of freelancers, reduction of time for accomplishing tasks. Variant calculations have been carried out, proving the effect of the integrated use of a wide range of levers to shorten the project time.

Keywords Project, terms of the project, freelancer,

RESUMEN:

El artículo describe la tecnología de gestión del tiempo del proyecto en condiciones de estrictas limitaciones de tiempo. La clasificación de los empleados de la organización se da dentro del marco del artículo, asumiendo los siguientes tipos: generador; operador; drones de oficina; organizador, profesional independiente. Se consideran diversas condiciones para la implementación del proyecto, que presentan las siguientes situaciones: las tareas se distribuyen solo entre los empleados del departamento, con cada trabajo realizado solo por un empleado específico; las tareas se distribuyen solo entre los empleados del departamento, pero puede aplicar el método del trabajo en equipo en una tarea específica; las tareas se distribuyen entre los empleados, y también existe la oportunidad de reducir el tiempo de trabajo de rutina debido a la creatividad del generador; utilice todas las palancas posibles de la gestión de proyectos: el generador, los profesionales independientes, el trabajo conjunto de varios empleados en una tarea. Sobre la base de una evaluación de la viabilidad de la implementación de todas las tareas del proyecto, se muestra el efecto de las diferencias en el rendimiento de los diferentes empleados durante la ejecución de las tareas individuales. Se determinan las palancas de la gestión del tiempo del proyecto: trabajo conjunto de los empleados en etapas separadas, atracción de profesionales independientes, reducción del tiempo para

productivity, critical path.

llevar a cabo tareas. Se han llevado a cabo cálculos de variantes, lo que demuestra el efecto del uso integrado de una amplia gama de palancas para acortar el tiempo del proyecto.
Palabras clave Proyecto, términos del proyecto, profesional independiente, productividad, camino crítico.

1. Introduction

Currently, the effectiveness of projects at manufacturing enterprises is largely determined by the effectiveness of the daily work of the project team. It is obvious that it is difficult to organize work in a team when the leader and his subordinates do not have modern methods of work, they do not improve their individual working style. Of course, the willingness of team members to succeed is determined by the knowledge, skills and qualities of the individual. However, an important role is played by the study of the cause-and-effect mechanism of the existing shortcomings and problems, as well as the search for ways to improve own work. Rational use of working time is crucial for eliminating shortcomings in the practice of daily activities. An important step in creating an effective system for managing your own time for the members of the project team is to define the objectives of the activity, both for a short and a long period. The foregoing determines the relevance and necessity of appropriate technologies of project time management at the enterprise to modern rhythm and complexity of operational tasks.

The theoretical and methodological basis of the research is based on the works of various aspects of project management, of such authors as: Anshin V.M., Demkin I.V., Nikonov I.M., Tsarkov I.N., Balashov A.I., Rogov Ye.M., Tikhonova M.V. Tkachenko Ye.A., B. Wolfson, O.N. Ilyina, K. Heldman, Yu.N. Lapygin, L. Leach, I.I. Mazur, V.D. Shapiro, N.G. Olderogge, R. Archibald, A. Stanley, T. DeMarco, Aycan, Z., Kanungo, R. N., Mendonca, M., Yu, K., Deller, J., Stahl, G., Khursid, A., Atkinson, R., Belyaeva, S.A. Besner, Hobbs B., Bryde, D.J., Carstens, D. S.,Richardson, G. L., &Smith, R. B. Cooke-Davies, De Wit, A., Farzana Asad Mir, Ashly H. Plinnington, Fortune, J., White, D., Jugdev, K., Walker, D., Frame, D., Frank Cervone, Gary Chin, Ismagilov, R.Kh., Fattakhov, H.I., Kent Beck, Lapygin, Yu.N., Lee-Kelley, L. Michael Cohn, Mingaleev, G.F., Uraev, N.N. Müller, R., Turner, R., Munns, A.K., Bjeirmi, B.F., Thomas, J., Mullaly, M., Kushimov, A.T., Kolesov, N.A., Westerveld, E., Xue-mei, X., Guang, Y., Chuang, L.

2. Materials and methods

The methodological basis of the study is dialectics as a method of cognition; fundamental research on the development of creative technical thinking; research in the field of general issues on project management (Aycan et al., 20006 p. 98; Fortune et al., 2011, p.46; Munns and Bjeirmi, 1996, p. 84; Anshin et al., 2008, p. 65; Ashmanov, 2008, p.49; Balashov et al., 2013, p.11; Leach, 2010, p.23; Mazur, 2004, p. 18; Newell, 2008, p. 32; Russell, 2004; Stanley, 2006, p. 44; DeMarco, 2006, p.154), project value and content management (Belyaeva, 2010, p. 81; Besner et al., 2010, p. 111; Bryde, 2003, p. 27; Mir and Plinnington, 2013, p.17; Thomas and Mullaly, 2009, p. 64), flexible project management technologies (Cervone, 2011, p. 74; Cohn, 2009, p. 95), monitoring and evaluation of project results (De Wit, 1988, p. 38; Ismagilov and Fattakhov, 2014, pp. 12-15; Lapygin, 2011, p. 3; LEE-KELLEY, 2006, p. 19; Müller and Turner, 2007, p. 18; Westerveld, 2003, p. 45; Lapygin, 2008, p. 11), studies in the field of project time management (Atkinson, 1999, p. 15; Carstens et al., 2013, p. 14; Cooke-Davies, 2002, p. 34; Ismagilov, 2015, p. 51), in addition, special issues of project management within lean manufacturing were considered (Mingaleev and Uraev, 2014, p. 19; Mingaleev and Uraev, 2014, p. 18; Mingaleev and Uraev, 2016, p. 135; Mingaleev, 2012, p. 113; Uraev et al., 2016, p. 39; Xue-mei, 2010, p. 27).

The leading method to investigate this problem is the system analysis method, which allows to

consider this problem as a purposeful and organized process to improve the project parameters in order to shorten the terms of its implementation and reduce the risks of terms' failure.

In addition, to develop the solution were used TIPS tools and project management, such as: a multi-screen scheme; consulting; wording technology and resolution of contradictions, algorithm for solving inventive problems, resource analysis, critical path method, PERT method, network graphing method, performance analysis method, time management methods.

The purpose of the article is to develop a technology for managing the timing of projects under conditions of severe time constraints and a lack of qualified personnel and the possibility of attracting temporary employees.

Scientific novelty consists in the following: the technology of search for project terms' reduction methods, including a number of stages, and also the complete set of the special cards filled by the head of the project while planning project works. An important feature of the technology is the emphasis on the appointment of executors to work, depending on their propensity to perform creative, organizational and routine tasks, which affects their productivity and the timing of individual tasks. The advantage of the technology is its simplicity and accessibility for easy perception by specialists who do not know the terminology and methodology of project management.

To describe the technology of project time management, consider the initial situation. The manager set a task for the employees of the department – to implement the project for a specific order during the day. In this case, there is a strict limitation on the timing of the project. The tasks themselves, which are part of the design of the project, have different character and different duration. The practical problem is the inconsistency of the required time for tasks and the available staff time.

The goal of the project planning is to distribute tasks among employees so that all tasks are solved in the conditions of a limited time budget for the project. Within the framework of the project were defined the following conditions:

1. All tasks have a different character – creative, routine, organizational.
2. All tasks are interrelated, that is, individual tasks can begin only after the termination of the other.
3. Staff is divided into 4 types of character – generator, operator, organizer, office drone.
4. All tasks have different duration.
5. All employees have different performance rate.

In the process of finding solutions, four situations were consistently examined, differing in the levers used to manage the project terms:

Situation number 1. Tasks are distributed only between the employees of the department, and each work is performed only by a specific employee. We do not have the right to use the services of freelancers, and also to apply the method of teamwork of two employees over the project.

Situation number 2. Tasks are distributed only between the employees of the department, but you can apply the method of teamwork of two employees on a specific task.

Situation number 3. Tasks are distributed among employees, and also there is an opportunity to reduce the time of routine work due to the creativity of the generator.

Situation number 4. We use all possible levers of project management – generator, freelancers, joint work of several employees over one task.

3. Results and discussion

Let us consider the types of tasks that occur during the project implementation. They can be classified into creative, routine and organizational. Creative tasks are tasks that are new to the

department. Routine tasks are tasks whose solution is known to the employees of the department. Previously, they had already solved these problems. The difficulty of such tasks lies in their commonness and monotony. To solve them, concentration and will are required. Organizational tasks are tasks that involve the ability to agree, accord with project parameters, and find a compromise with other people. To solve them, you need negotiation skills and the ability to feel the mood of other people.

The project involves 4 employees of the department, who differ in their propensity to solve various problems. Characteristics of employees' types are presented in Table 1.

Table 1
Characteristics of organization's employees

Generator	Perform creative tasks best, because he likes to use his intelligence. The generator performs routine tasks poorly because he does not like monotonous and uninteresting work. He also does poorly with organizational work, as he has low organizational abilities.
Operator	The operator successfully copes with routine tasks. The operator is created for solving tasks in real life. He has no desire and no time for creative search. However, if necessary, he can solve the creative task, although worse than the generator. He averagely does organizational tasks, because he does not like to talk for a long time.
Office drone	Office drone comes to work to communicate with colleagues and exchange messages through social networks. He has no great interest in the work, so he has low productivity in all kinds of tasks. More or less copes with routine tasks, if there is an understandable instruction.
Organizer	The organizer successfully copes with organizational tasks. It is easier for him to find someone to solve a problem than to do it himself. Creative and routine tasks go poorly for him, since he does not like to concentrate and do a methodical search.
Freelancer	Employee working in remote access mode. We use him to perform part of the work only if necessary. He is not the company's staff and we pay him only when we see the end result. He can perform some routine and organizational tasks in this game.

Table 2 describes the time spent on solving tasks. The time costs are described on the assumption that the task is performed by the employee with the lowest qualification.

The department staff can perform all types of tasks, but with different efficiency.

So, the generator quickly does creative tasks, but organizational and routine go slowly for him, such as B, C, E, F, G, H, J, K, M, N, P. The operator quickly does routine tasks, but is not ready to engage in creative and organizational tasks, such as A, D, I, L, O. Organizer easily copes with organizational tasks, while routine and creative tasks he tries to avoid.

Characteristics of employees' qualifications are shown in Table 3.

Table 2
List and characteristics of tasks of the department employee

Task code	Task type	Time spent on the task, h
A	Creative	4
B	Routine	4
C	Organizational	3
D	Creative	4
E	Routine	6
F	Organizational	3
G	Organizational	2
H	Routine	5
I	Creative	2
J	Routine	2
K	Organizational	3
L	Creative	2
M	Routine	3
N	Organizational	3
O	Creative	2
P	Organizational	2
	Total	

Table 3
Characteristics of employees’ qualifications by tasks type

Task type	**Employees’ titles**			
	Generator	**Operator**	**Office drone**	**Organizer**
	Employees’ qualifications			

	High	Av.	Low	High	Av.	Low	High	Av.	Low	High	Av.	Low
Creative	+				+				+			+
Routine			+	+				+				+
Organizational			+		+				+	+		

Different skill levels suggest performance differences. That is, an employee with high qualifications will do the job 2 times faster than an employee with low productivity. The performance ratio is shown in Table 4.

Table 4
Time spent on tasks for employees of different qualifications

Qualification	High	Average	Low
Time spent on tasks, %	50%	75%	100%

As an example, let us consider task A. Task A has a creative character. It requires 4 hours of time for an employee with low qualifications. If an average-qualified employee does it (for example, an operator), he will spend – 4 * 75% = 3 hours of time.

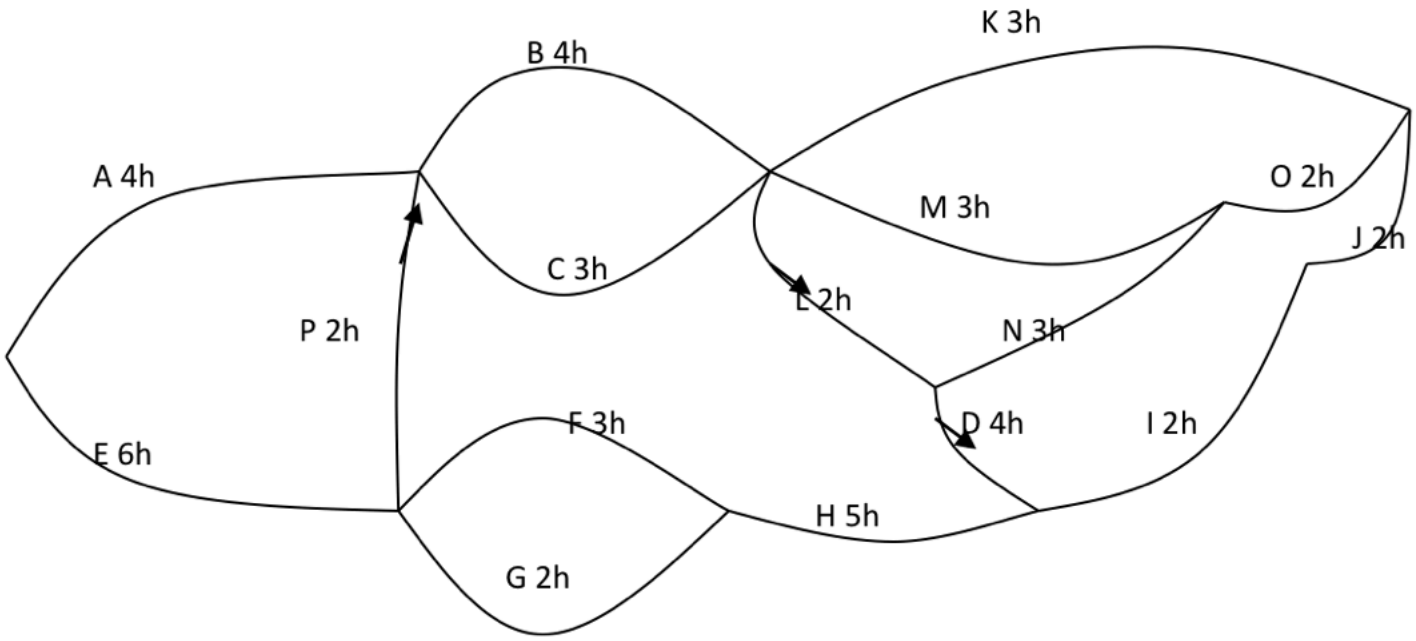
If this task is done by an employee with high qualifications (for example, a generator), he will spend – 4 * 50% = 2 hours of time. Network project schedule in figure 1.

Table 5
Connections between tasks

Task code	Follow-up task	Prior task
A	Start	B,C
B	A,P	K,M,L
C	A,P	K,M,L
D	L	I
E	Start	P,F,G
F	E	H
G	E	H
H	F,G	I
I	H,D	J
J	I	Finish
K	B,C	Finish

L	B,C	N,D
M	B,C	O
N	L	O
O	M,N	Finish
P	E	B,C

Figure 1
Network project schedule



Each task has its own character and requires a certain amount of time. All tasks have connections among themselves, that is, individual tasks can begin only after the completion of another task (Table 5). Tasks performance time can be divided into smaller periods between individual employees.

Next, let us consider the levers of time management. The participants of the projects have the opportunity to shorten the time spend on the task with the help of the following levers:

- joint work of two employees on the task;

- involvement of a freelancer to participate in the project;

- ask the generator to come up with a simplified way of accomplishing the task;

- a combination of all the specified time management tasks.

Using the lever number 1 – it is the joint work of two employees on the task. When determining the working time, it is necessary to consider which method of organization of work is used **–** individual or group. If the work is done individually, that is, one employee is working on the task, then the working time is determined by the formula:

Work time = Base time for the task * Employee’s productivity.

The base time for the task is determined by the time that the employee with the lowest productivity will spend on work. His time is taken as a basis.

For example, task A is creative and takes 4 hours to complete.

If it is performed by an office drone with low qualifications, he will complete this task in 4

hours. (4 hours * 100% = 4 hours).

If it is performed by an operator with an average qualifications, he will complete this task after 3 hours (4 * 75% = 3 hours).

If the job is done by a generator with high qualifications, then he will complete this task after 2 hours (4 * 50% = 2 hours).

If two employees work on the task at the same time, it is required to distribute the amount of work between them. At the same time, the task must be done completely and they must finish their work areas at the same time.

It is necessary to solve the equation for this:

Productivity of the employee number 1 * The amount of work of the employee number 1 = Productivity of the employee number 2 * The amount of work of the employee number 2.

Therefore:

Time for the task completion of the employee number 1 / Time for the task completion of the employee number 2 = The amount of work of the employee number 2 / The amount of work of the employee number 1.

For example, the task is creative and takes 3 hours to complete.

If it is performed by an office drone with low qualifications, he will complete this task in 3 hours. (3 hours * 100% = 4 hours).

If the job is done by a generator with high qualifications, then he will complete this task after 1.5 hours (3 * 50% = 1.5 hours).

Let us divide the work between two employees, so that the total time of task completion is minimal.

3/1,5 = 2. From here it is visible, that the ration of work amount of the generator and office drone equals 2:1. The generator takes 2/3 of the work, and the office drone takes 1/3 of the work.

Due to its performance, the generator will do 2/3 of the work (3 * 2/3 = 2 hours) for 1 hour (2 * 50%), while the drone will do 1/3 of the work (3 * 1/3 = 1 hour) for 1 hour (1 * 100%).

As a result, the total time when working together will be 1 hour. The correlation of the parts of work between employees in the joint work is presented in Table 6.

Table 6
The work ratio in the joint work of different types of employees

Productivity of the employee No. 1	**Productivity of the employee No. 2**		
	High	**Average**	**Low**
High	1:1	1,5:1	2:1
Average	1:1,5	1:1	1,3:1
Low	1:2	1:1,3	1:1

Example: We need to divide the routine work between the operator (employee number 1) and office drone (employee number 2). The base work time is 5 hours.

We look at the productivity of employees for this type of work. The operator has it high, drone has it average. The ratio of the work amount will be 1.5:1. That is, the total number of parts is

2.5. Drone will take the amount of work of 2 hours, and the operator - 3 hours of work. As a result, the work will be completed in 2 hours (the operator will spend 2 hours, rather than 3 hours, on his work amount).

Using the lever number 2 - Freelancer. Part of the tasks the project participants can delegate to the side (to the freelancer). Freelancer can perform part of routine and organizational tasks.

Table 7
Cost of freelancer services

Routine tasks	Base time, min	Costs,% of budget	Organizational tasks	Base time, min	Costs,% of budget
B	240	5	C	180	5
E	360	7	F	180	5
H	300	5	G	180	5
J	180	3	K	180	5

It is considered that you have found a freelancer with high qualifications, therefore:

- the execution time is shortened;

- project participants can do other tasks and shorten the time of their completion.

Freelancer can perform the following tasks:

Routine tasks - B, E, H, J

Organizational - C,F,G,K.

The cost of freelancer services. Typically, the cost of freelancer services is determined as a percentage of the total project budget (Table 7)

There is a limit on the cost of freelancer services – in total you can spend no more than 25% of the project budget.

Using the lever number 3 - Generator. One of the department staff has creative abilities (generator). He can come up with a new technology that shortens the execution time of the task. However, as in any creative task, there is a risk that the new technology will not be able to come up, and then the generator will waste time idle.

Therefore, the project participants face a choice:

Trust the generator to develop a new technology with a probability of success of 75% and allocate him a time for this;

Continue to work according to the old technology with a high time consumption, but without the risk of losing time on the new technology development. The characteristic of the generator’s work is given in Table 8.

Table 8
Indicators of the generator’s work

Indicator	Meaning
Probability of success	75%

Reduction of the initial operation’s duration	50%
Time to find a solution,% of the base time	15%

Using the lever number 4 - Exchange of tasks. Project participants can exchange project tasks among themselves. In this case, the gain is achieved due to the fact that the participants solve the tasks that they are best at.

Using the lever number 5 - Cancel individual tasks. Customers can change their requirements, therefore, part of the task disappears. This possibility is of a probabilistic nature, therefore, participants should think carefully before postponing a specific task.

Next, let us consider the terms of the project financing. If the department successfully copes with the project in the required time, it receives the agreed amount in full. If the department delays the project, the amount of compensation is reduced through penalties. So, extending the project time by 10% entails a loss of 20% of the money.

Table 9
Characteristics of fines with time delay

Time delay, %	Fine, % of budget
0	0
10	20
20	50
30 and more	70

If the terms are delayed by 20%, then the payment is reduced by 50%. If the project is delayed by 30% or more, the payment is reduced by 70%.

The department has the right to allocate up to 25% of the total project budget for freelance services. The characteristics of the project financing terms are given in Table 9.

Taking into account these prerequisites and conditions of project implementation, we carried out variant calculations for different situations. In situation number 1, the tasks are distributed only between the project participants, without involving freelancers and using the services of the generator, according to the principle: there is work – we distribute it among people taking into account their qualifications.

As calculations show, in situation No. 1, the department does not complete the project at the set time. The department needs about 13 hours to complete the project and accordingly this leads to a sharp drop in the level of the project fee.

Next, we have consistently considered situations 2, 3 and 4. As calculations show, the most effective way to reduce the project time is to work within the framework of situation No. 4, when a wide range of time management techniques is used.

The total time spent on the project in situation No. 4 was 8 hours 30 minutes, which is significantly less than in other cases.

4. Conclusions

1. In the conditions of limited time, the implementation of projects requires the development of new approaches and technologies for project time management. These technologies are developing in several directions – technical and technological, organizational, personnel. The

first direction involves the search for methods and ways to reduce certain types of work by using new types of equipment and machinery. The second direction involves the search for methods of arranging works over time, as well as the distribution of executors for individual tasks, taking their qualifications into account. The third direction presupposes the management of the number of executors involved in performing work on a permanent and/or temporary basis. Complex application of all directions increases the likelihood of obtaining an effect on a significant project time reduction.

2. Effective project time management in the activities of organizations requires that the project manager knows the individual project management levers and also understands their content and the resulting effect from their application. Among the tools we identified such tools as the joint work of several employees on individual tasks, the attraction of a modern human resource such as freelancers, as well as the use of such an innovative internal resource of the organization, as the activation of the individual employees' creative thinking. Awareness of the project manager about the principle of the use of such leverages, as well as their free possession also has a positive impact on the project's results.

3. Successful work on the reduction of the project period involves a detailed preliminary study of the project plan, including the formation of a work list on the project, clarifying the content and nature of the work, identifying the links between the tasks. In addition, it also requires an understanding of the relationship between the nature of the work and the qualifications of individual executors for different types of work, which provides a multiple growth in productivity in comparison with the intuitive placement of executors to do the tasks. In order to improve the efficiency of project planning, we propose the creation of a network schedule for the project and its further optimization through modeling and testing of individual options for its implementation. This makes it possible to significantly reduce the number of potential errors during the project implementation stage and, accordingly, to avoid excessive time spent on eliminating failures.

4. To improve the processability of the work on project time management, we propose a technology to search for methods to shorten project terms, including a series of stages, as well as a set of special maps filled by the project manager when planning the project. The main feature of this technology is its simplicity and accessibility for accelerated perception by specialists, even those who do not know the specialized terminology and methodology of project management. In addition, this technology does not require the use of special software, which often complicates the work on the project, if the employees have no experience with programs.

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