

Development of main strategies of project management of production-technological potential usage by divisions of underground

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Abstract

In modern conditions, the underground divisions use their production and technological potential insufficiently. The main reasons for this situation are the lack of strategies for effective formation and implementation of management actions aimed at ensuring the necessary level of production and technological potential usage. Efficient use of production and technological potential by the structural divisions of underground is possible if there are a comprehensive solution of applied scientific

management objectives and development of usage strategies for effective formation and implementation of management actions to ensure the necessary level of production and technological potential usage by the structural divisions of underground.

At the same time, the production processes management of structural divisions is one of the main objectives of improving the usage efficiency of its production and technological potential.

The main task of divisions production processes management is multidimensional, which implements various strategies of using its production and technological potential. An effective solution of the set of considered and developed in the article technical, technological, economic and organizational strategies provides the increase in the level of production and technological potential usage and enables demand that exceeds supply (available production and technological potential of underground divisions).

Key words: PRODUCTION AND TECHNOLOGICAL POTENTIAL, PROJECT, PROCESS, PRODUCTION PROCESS, INTERNATIONAL STANDARD ISO 9000, UNDERGROUND, OPTIMIZATION STRATEGY

Problem statement

In modern conditions, the underground divisions use their production and technological potential insufficiently. The main reasons for this situation are the lack of strategies for effective formation and implementation of management actions aimed at ensuring the necessary level of using the production and technological potential. Efficient use of the production and technological potential (PTP) of underground structural divisions is possible if the applied scientific management tasks are solved and the utilization strategies are developed [1-4].

The presentation of the main material

Production processes management of structural divisions is one of the main objectives of improving the efficiency of using its production and technological potential [5]. Production processes from the standpoint of cybernetics can be considered as controlled feedback processes.

At the same time, a combined principle of management taking into account the control on the deflection, perturbation and state is implemented. This approach, as it has been shown by researches, provides the most efficient use of production and technological potential of underground in accordance with the international standards ISO 9000 [4-7].

The main task of production process management of the divisions is multidimensional, where various strategies of its production and technological potential usage are implemented. A competitiveness assessment of underground services divisions should be used when carrying out the organizational and technical measures of the effective solution of applied tasks of underground operation. All tasks related to the functioning of underground PTP should be resolved comprehensively taking into account the relationships in accordance with the system purpose of the underground divisions functioning [6, 2] (Fig. 1).

This is achieved with the help of marketing analysis based on extensive use of information means.

The marketing analysis is an integral part of the system analysis and it includes the commercial activity of the structural division. The system marketing requirements are formed depending on the production volume and marketing activities, an object, and many other factors. Marketing activity should provide [8]:

- formation of such works corresponding to the market requirements; required impact on consumers and demand, which provides the best possible control over the distribution sphere.

- reliable information about the situation on the market about structure and dynamics of the demand for underground services, etc., i.e. information about the external environment;

Marketing analysis involves the formation of the requirements for the works quality and quantity of underground divisions [1, 9]:

- evaluating the results of individual structural divisions and development of proposals for their improvement;

- formation of strategy, tactics, and methods for assessing demand, and stimulation mechanisms of services implementation;

Major organizational marketing tasks can be divided into external and internal. External tasks are:

- analysis of demand volumes in the context of individual indicators characterizing it and market segmentation; research of the competitors and the quality of work carried out by them.

- study of regularities and trends in the main indicators of production and economic activity and the market condition;

- assessment of the impact of scientific and technological progress on the underground activity taking into account the real situation and options for the development of its production and technological potential.

The internal tasks include:

- assessment of the potential volume of orders that are not implemented by structural divisions;
- study of the range of services and the assessment of the level of customers satisfaction;
- formation of the logical structure of the objectives, functions, tasks and methods of their solution, which provides their systematic connection in the pro-

cess of implementation in the real conditions;

- analysis of the causes of defects, a malfunction of underground operation, failures of devices and equipment;
- assessment of the risk level in relation to the effective implementation of the objectives and planned organizational and technical measures;

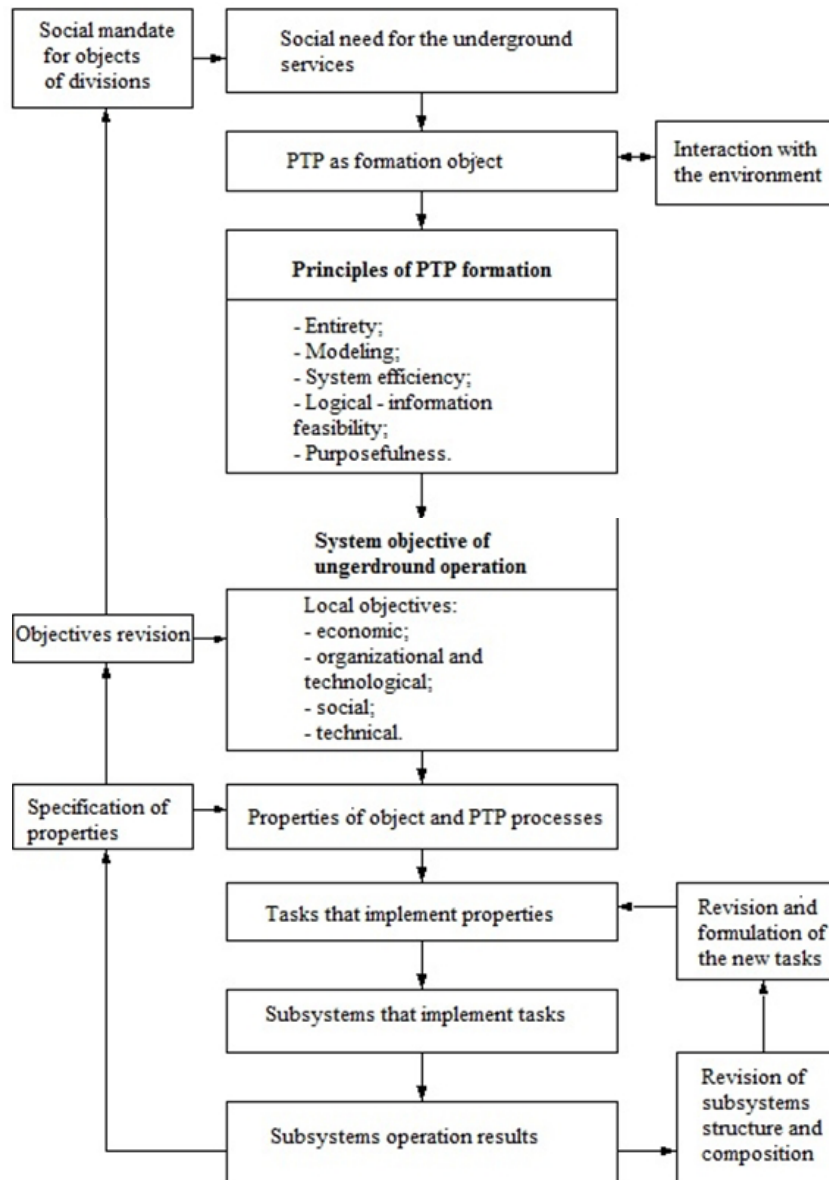


Figure 1. Main principles of production and technological potential of underground divisions

- study of the possible income from the new types of repair services by underground divisions;
- assessment of the investments needed to meet the new tasks of improving the efficiency of using the production and technological underground potential.

The main criteria for the marketing evaluation can be:

- reducing the cost of performed works;
- growth of the nomenclature of orders;
- increase in profit from the distribution of services, etc.

Under the market conditions, the underground operation largely depends on the conditions for its services. There is a need to study the demand and formation on this basis of the commercial and technical-technological behavior of underground divisions including pricing policy formation.

The price on services of underground is formed depending on the demand for it and the production and technological potential of its divisions, i.e.

$$P_{ij} = F(N_{1ij}, N_{2ij}), \quad i = 1, 2, \dots, m; \quad j = 1, 2, \dots, n, \quad (1)$$

where F – price for the repair of i -th object of j -th technological process;

N_{1ij}, N_{2ij} – respectively demand for the i -th object of the j -th technological process and production and technological potential of the division for repair of the i -th object using the j -th technological process.

The corresponding nomenclature of repair objects can be written as [1, 4, 11]

$$P_{ij} N_{1ij} = P_{ij} N_{2ij}, \quad (2)$$

Equation (2) indicates that the demand for the ser-

$$F_{Dijp} = [365 - DO - H] * 8.2 - PHD * I] * Z_{ij} * K_r, \quad (4)$$

where DO - the number of days off per year;

H - the number of holidays per year;

PHD - the number of pre-holiday days per year (the duration of the working day is less for one hour)

Z_{ij} – the number of operation shifts of technological equipment of p -th item when the repair with the j -th technological process of the i -th repair object;

K_r – coefficient taking into account the residence time of the p -th equipment under repair;

K_{Lijp} – load factor of the p -th equipment when repairing with j -th technological process of the i -th repair object;

C_{Eijp} - amount of equipment of p -th identity required for the repair with the j -th technological process of i -th repair object;

t_{ijp} – complexity of performed works on the p -th equipment when repairing with the j -th technological process of i -th object;

α_{ijp} – permissible loss ratio on the changeovers of p -th equipment when repairing with j -th technological process of i -th object over the set-up time.

The price on services of the enterprise is formed depending on the demand and PTP divisions (supply). For the formation of price changing mechanism

prices of the enterprise should be equal to its real potential at this time interval (equality condition).

Production and technological potential of underground divisions is found using the following ratio:

$$N_{2ij} = \sum_{p=1}^n \frac{F_{Dijp} K_{Lijp} C_{Eijp}}{t_{ijp} (1 + \alpha_{ijp})}, \quad (3)$$

where F_{Dijp} – efficient annual fund of equipment time of p -th item in the repair with the j -th technological process of the i -th repair object;

we introduce the quantity

$$Z_{ij} = N_{1ij} - N_{2ij} \quad (5)$$

If $Z_{ij} > 0$, the demand for production of underground exceeds PTP, if $Z_{ij} < 0$, PTP exceeds demand.

Under real conditions of underground operation, such strategies of price formation can be used:

- change of price is in proportion to the excess demand;

- change of price is in proportion to the excess supply;

- change of price corresponds to the demand and supply.

Prices stability lies in condition when the demand for the products and services of the enterprise is satisfied.

Let us consider the main strategies of using the production and technological potential of the structural divisions of underground. Considering the peculiarities of functioning of underground production processes and the level of usage of its production and technological potential, there are three alternative strategies for using its production and technological potential (Table 1).

Table 1. Strategies of production and technological potential usage of the structural divisions of underground

Strategy name	Indication	Ratio between demand and supply	Criteria value	
			quality	efficiency
1st strategy	S_1	$N_{1ij} = N_{2ij}$	$q_f = 1$	$e_f = 1$
2nd strategy	S_2	$N_{1ij} < N_{2ij}$	$q_f < 1$	$e_f < 1$
3rd strategy	S_3	$N_{1ij} > N_{2ij}$	$q_f > 1$	$e_f > 1$

Strategies of using the underground production and technological potential differ by the ratio between the demand for production of the enterprise N_{1ij} and supply (production and technological potential) – N_{2ij}

and quality and efficiency indicators of production process management, which are determined according to the following expressions:

$$q_f = 1 - \left(\frac{\int_0^t |Q(t) - \bar{Q}(t)| dt}{\int_0^t \bar{Q}(t) dt} \right), \quad (6)$$

$$e_f = 1 - \left(\frac{\int_0^t |D_1(t) - \bar{D}_1(t)| dt + \int_0^t |D_2(t) - \bar{D}_2(t)| dt}{\int_0^t \bar{D}_1(t) dt + \int_0^t \bar{D}_2(t) dt} \right), \quad (7)$$

Improving the level of production and technological potential of underground usage in the implementation of strategies provided in Table 1 can be achieved by solving the set of respective tasks.

The first strategy is

$S_1 = S_1 \{N_{1ij} = N_{2ij} \wedge q_f = 1 \wedge e_f = 1 \wedge Z_{ij} = \emptyset$ and predetermines the full use of production and technological potential of structural division. This strategy is the most rational (optimal) and it can occur under real conditions of underground operation. When implementing S_1 strategy the set of all tasks included in the system model of the underground operation are solved completely ensuring the maximization of the quality and efficiency indicators of structural division production processes management ($q_f = 1, e_f = 1$).

Due to the fact that the optimization of underground production processes management and the use of its production and technological potential is reduced to the creation of external and internal conditions, that would result in the implementation of the first strategy S_1 .

The second strategy of using the production and technological potential implies an excess of supply over demand

$S_2 = S_2 \{N_{1ij} < N_{2ij} \wedge q_f < 1 \wedge Z_{jk} = Z_{jk}\}$, which stipulates underutilization of production and technological potential of roads repair and thus decrease in quality and efficiency of management ($q_f < 1, e_f < 1$). In order to balance supply and demand, prices for the products and services of the enterprise can be reduced according to the previously outlined

recommendations. In addition, to ensure the necessary level of use of production and technological potential of underground, it is necessary to solve the set of tasks by optimizing the technical level of production. The search for effective financial mechanisms, cooperation between enterprises and structural subdivisions using their services and products can significantly improve the use of production and technical potential and, as a result, the financial condition of structural division.

The third strategy of using production and of technological potential implies dissatisfaction with the market demand

$$S_3 = S_3 \{N_{1ij} > N_{2ij} \wedge Q_f = 1 \wedge e_f = 1 \wedge Z_{jk} = Z_{jk}\}$$

The excess of demand over supply ($N_{1ij} > N_{2ij}$) enables stable operation. However, to meet the demand reserve the following tasks should be solved:

- providing the modern technological processes to the underground;
- optimization of technological processes of rolling stock and facilities repair;
- optimization of production equipment and tooling usage.

Effective solution of many of these and other technical, technological, economic and organizational tasks provides the increase in the level of using production and technological potential and enables demand that exceeds supply (available production and technological potential of underground divisions). In real terms, at this stage, this strategy is found less than S_2 strategy, which is due to the overall decline in production.

Thus, the production processes of underground divisions can be managed by choosing appropriate strategies that ensure the most effective using of the production and technological potential.

Conclusion

The appropriate strategies for effective formation and implementation of management actions aimed at ensuring the necessary level of usage the production and technological potential of the structural divisions of underground were proposed.

References

1. Fomin O.V. (2015) Increase of the freight wagons ideality degree and prognostication of their evolution stages. *Scientific Bulletin of National Mining University*. No 2. p.p. 68-76.
2. Kelrykh M. (2014) Perspective directions of planning carrying systems of gondolas. *Metallurgical and Mining Industry*. No 6. p.p. 64-67.
3. Fomin O.V. (2014) Modern requirements to carrying systems of railway general-purpose gondola cars. *Metallurgical and Mining Industry*. No 5. p.p. 31-43.
4. Fomin O. V. (2015) Improvement of upper bundling of side wall of gondola cars of 12-9745 model. *Metallurgical and Mining Industry*. No 1. p.p. 45-48.
5. Dorf R. (2004) *Sovremennyye sistemyi upravleniya* [Modern control systems]. Moscow: Laboratoria basovyh znaniy. 832 p.
6. DSTU ISO 9001:2009 *Systemy upravlinnia yakistiu. Vymohy* [Quality management systems. Requirements].
7. DSTU ISO 9000:2007 (ISO 9000:2005, IDT) National standard of Ukraine. *Systemy upravlinnia yakistiu. Osnovni polozhennia ta slovnyk terminiv* [Quality management systems. The main provisions and terms glossar.
8. Kotler F. (2015) *Osnovy marketinga. Kratkiy kurs* [Marketing Essentials. Short Course]. Moscow: Williams. 496 p.
9. Utkin E. A. (1998) *Strategicheskoe planirovanie* [Strategic Planning]. Moscow: Tandem. EKMOS. 440 p.
10. Melnichenko O. I. (2011) Rozrobka stratehii vikoristannia vyrobnycho-tehnologichnogo potentsialu pidrozdiliv koliynogo gospodarstva metropoliteniv [Development strategies of using the production and technological potential of railroad facilities divisions of underground]. *Upravlinnia proektami, sistemniy analiz ta logistyka: Naukoviy zhurnal* [Project management, systems analysis and logistics: Science journal]. Vol. 8. Kyiv: NTU, p.p. 146-150
11. Sitnic V. F., Karagadova E. A. (1985) *Matematicheskie modeli v planirovanii i upravlenii predpriyatiem* [Mathematical models in the planning and management of enterprise]. Kyiv: Vishcha Shkola, 214 p.

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