Improving the production activities of a unit of an industry-specific company

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Abstract. The goal of finding ways to optimize the production and economic activities of enterprises is usually cost optimization. In this case, the solution of the indicated problem should occur without compromising the organization of production processes of the enterprise units. In this regard, the most urgent is the search for possibilities to increase the efficiency of the use of resources available to the economic entity. The article presents the results of an analysis of indicators of production activity of a unit of an industry-specific company, considers the areas of searching for and utilization of reserves for the growth of production organization efficiency.

1. Introduction
An integral part of the strategy to increase the efficiency of the core business of any production company is to ensure cost control and the desire to its constant reduction. At the same time, the cost-cutting program implemented by the enterprise is based on measures that allow the use of internal reserves to reduce the cost of materials, fuel and energy, increase the efficiency of the use and operation of fixed assets.

The object of the study, the purpose of which was to search for opportunities for increased efficiency and, as a result, production, financial and economic indicators of the enterprise, was the production structural unit of one of the leading Russian oil companies.

2. Materials and methods
An important condition for the smooth operation of the enterprise is the full security of the need for material resources with sources of coverage \[1, 3\]. Analysis of material and technical supply showed incomplete implementation of the plan for the supply of material resources, delays in supplies. The organization of transport services revealed a lack of vehicles. These shortcomings became the reasons for unproductive time during the repair of wells.

When analyzing the organization of repair work, unproductive time was revealed, i.e. downtime for reasons such as waiting for transport, lack of material and technical resources and pipes.

With a significant distance of oil production areas from the Central pipe base, transporting pipes over long distances becomes technically and economically inexpedient. In these cases, in the immediate vicinity of promising and existing production areas, it is possible to create a rolling repair shop or a pipe repair site. At the enterprise under study there is no such workshop and tubing repair, as indicated above, is carried out at the pipe base. This leads to some disadvantages, such as high transportation costs, unproductive loss of time, including due to untimely delivery of pipes, poor-quality repair, etc. \[7\]
The number of well accidents has increased for various reasons, including because of poor-quality pipe repair, their use without rejection, poor quality of pipe metal, careless handling of pipes during loading, unloading, transportation and storage.

Figure 1 shows a scheme of reserves to increase production efficiency [2, 4].

Based on the analysis of the effectiveness of the study object and the analysis of the organization of auxiliary production of the enterprise, it is possible to identify the most important reserves for increasing the efficiency of production activities in the following areas:
- use of material and technical base;
- use of labor in time and technical parameters;
- introduction and use of advanced technology and technical equipment of production;
- increase in production organization efficiency.

**Figure 1.** Reserves for increasing production efficiency
To increase the efficiency of the production activities of the structural unit, which consists in increasing the volume of production at minimal cost, based on the identified reserves and following the classification of areas for increasing the efficiency of production activities [9, 15], the following areas can be proposed in which it is necessary to develop measures to increase the efficiency of production activities:

1. Reduced repairs.
2. Elimination of losses of working hours of equipment.
3. Economic use of materials, their recycling.
4. Rational organization of transport services.

Investigation of the causes of accidents is carried out by the reliability department of the Engineering-Economic Implementation Center of the parent company. According to their data, 94 downhole equipment failures occurred in the reporting year, including due to breakdown of tubing, due to its use without rejection, substandard repair, operation and transportation. To meet the needs of drilling and production, the oil company includes the Central Pipe Base, which carries out repair and maintenance of pipes, which is located at a distance of 90 km from the production facilities of the structural unit under study. Transporting pipes over such distances requires significant transportation costs and time. With a significant distance of the Central Pipe Base from oil production areas, transportation of pipes becomes economically inexpedient. [8, 14].

3. Results and Discussion

Analysis of the use of transport by type of service showed a large share of its load being internal freight due to the large volume of pipe transportation to the central pipe base, as a result of which there is a lack of transport at other production sites. Incomplete fulfillment of the plan of procurement, violation of its smooth flow also became the causes of unproductive losses of working time during the repair of wells.

These and other reasons influenced the increase in the number and duration of well repairs (Table 1), which led to a decrease in the potential volume of oil production.

| Indicator               | Previous year | Reported year | Deviation from previous year |
|-------------------------|---------------|---------------|------------------------------|
| Total repairs including:| 1932          | 1984          | +70                          |
| - routine               | 1681          | 1722          | +56                          |
| - major                 | 251           | 262           | +14                          |
| Average duration of 1 repair, hour: |             |               |                              |
| - routine               | 83.1          | 85.6          | +2.5                         |
| - major                 | 601.3         | 608.8         | +7.5                         |
| Overhaul period, days   | 433           | 439           | +2                           |

In the reported year, the total number of repairs increased both in comparison with the previous one and in comparison with the plan. The average duration of one repair has also increased. As a result, the overhaul period of the wells was reduced by 4 days.

When analyzing the number of repairs, it is very important to find out the reasons for the deviations of the actual number of repairs from the planned one, since the increase in the duration of repairs is the cause of the decline in oil production [5, 6]. So, in the reported year, the number of routine and major repairs increased compared with the plan by 15 and 3, respectively. An increase in the number of routine and major repairs compared to the plan indicates unplanned downhole equipment failures and accidents, as planned underground repairs are made to prevent them.

A comparative analysis of the balance of working hours of well workover for the study period indicates a change in the ratio of production and non-production time. In the previous year, productive
time amounted to 94.26% of the total time structure, in the reporting year it decreased slightly and amounted to 93.11%. The rest of the time in the balance of workover for the reporting year - 6.89% - was unproductive time, i.e. downtime. Table 2 shows the distribution of crews’ downtime by causes of downtime.

| Causes of downtime | Previous year | Reported year | Deviation |
|--------------------|---------------|---------------|-----------|
|                    | Total hours   | Share, %      | Total hours | Share, % | hours | %     |
| Weather conditions | 4609          | 27.7          | 9385       | 43.9     | +4776 | 236.8 |
| Lack of fuel and lubricants | 18 | 0.1         | 44         | 0.2      | +26  | 244.4 |
| Waiting for materials | 1857       | 11.1          | 2381       | 11.1     | +524  | 128.2 |
| Elevator repair    | 1790          | 10.7          | 1334       | 6.2      | -456  | 74.5  |
| Lack of special vehicles and equipment | 3667  | 22.0          | 2869       | 13.5     | -798  | 78.2  |
| No kill fluid      | 496           | 3.0           | 509        | 2.4      | +13   | 102.6 |
| No vehicles for moving | 1286      | 7.7           | 1085       | 5.1      | -201  | 84.4  |
| Waiting for Geophysicists | 246    | 1.5           | 321        | 1.5      | +75   | 130.5 |
| No shift transport | 0             | 0             | 5          | 0        | +5    | -     |
| Waiting for technical operations | 89    | 0.5           | 76         | 0.4      | -13   | 85.4  |
| Waiting for pipes  | 678           | 4.1           | 758        | 3.6      | +80   | 55.9  |
| No electricity     | 140           | 0.8           | 156        | 0.7      | +16   | 111.4 |
| Repair of equipment, tools | 621       | 3.7           | 594        | 2.8      | -27   | 95.7  |
| Understaffing      | 351           | 2.1           | 50         | 0.2      | -301  | 14.2  |
| Stop of Regional Surveying Company’s work | 838  | 5.0           | 1798       | 8.4      | +960  | 214.6 |
| TOTAL              | 16686         | 100           | 21365      | 100      | 4679  | 128.0 |

As can be seen from the Table, non-productive time in the reporting year increased by 4679 hours compared to the previous year. The main reason for this increase is the increase in downtime due to weather conditions, which amounted to 9385 hours in the reporting year versus 4609 in the previous one. Downtime due to lack of materials also increased (by 524 hours), but their share in the structure did not change. Indicators such as elevator repair and lack of special machinery and equipment for moving dropped and the decrease in downtime for these reasons amounted to 456, 798 and 201 hours, respectively. An indicator such as waiting for pipes increased by 80 hours, and downtime due to understaffing decreased by 301 hours.

4. Conclusion

The foregoing has become the basis for developing a program to improve the efficiency of production activities of the company. In order to improve production and economic activities, it is advisable to implement the following measures (Figure 2) [10, 11-13]:

1. Opening of a workshop for repair of tubing in the pre-production workshop with the use of the new Tuboskope Vetko flaw detection unit during repair. The Tuboskope Vetko unit is a fully computerized inspection installation for monitoring and tubing. This is a fundamentally new modern equipment, which yielded positive results when tested and used in a similar profile enterprise. The unit is designed to conduct research of tubing and pipe products made of ferromagnetic material, with the aim of identifying transversely oriented defects, corrosion pits and metal loss of the pipe wall, as well as monitoring the grade of steel. The production line with the Tuboskope Vetko unit allows repairing one tubing up to 2-3 times, which increases the useful life of tubing 1.5-2 times and improves the quality of their repair. Pipe inspection allows reducing the number of repairs to 9% per year due to a more
accurate determination of the suitability of the pipe for further operation and the quality of repairs. The practice of restoring damaged parts and assemblies instead of acquiring new ones.

2. Justification and introduction of the required number of missing pieces of equipment to reduce downtime due to lack of transport.

![Diagram](image)

**Figure 2.** Areas for improving the production activities of the oil company unit

The proposed program of measures includes significant changes in the organization of production activities, namely, the rejection of the services of the Central Pipe Base for the repair and maintenance of tubing and involves the creation of its own pipe repair shop, the purchase of a repair line with flaw detection to make pipe repairs more efficient. An effect is expected from the installation in the form of a reduction in the number of repairs due to a reduction in accident rate and unplanned failures of downhole equipment.

The organization of its own tubing repair shop will require additional costs for its creation and maintenance, but the refusal of the Central Pipe Base services frees up funds that should cover the costs of maintaining the tubing repair shop. In addition, cost savings are expected due to a reduction in transportation costs in terms of transporting pipes to the Central Pipe Base.

The proposed measure to save material and technical resources involves specific material values, which with modern technology can be restored and repaired. These are the lock supports, valve seat saddles and rods. Previously, they were not restored, which required large material costs for the acquisition of new ones. The introduction of the practice of restoration of these resources will allow significant savings in reducing material costs. In addition, this measure will reduce downtime due to the lack of these material resources.
To implement this program, the values of the cost of fixed assets and the number of personnel of the enterprise should increase by 0.4% and 0.5%, respectively.

The calculations showed the effectiveness of the implementation of these measures. The expected effect should be expressed in a reduction in material and transportation costs, in a reduction in the number of repairs, which in turn will save costs for repairs and increase the operating time of wells.

For the comparison base in the calculations, the actual values of the indicators of the reported year were taken with constant indicators of the number of wells in the existing stock and the average production rate of wells. Implementation of the proposed program to improve the production and economic activities of the enterprise unit will allow increasing oil production by 10 thousand tons. The cost of 1 ton of gross oil under these conditions should decrease by 3.9%, which in the current economic conditions is the most important indicator of the effectiveness of the proposed measures.

Thus, the analysis of the production activities of the studied structural unit of the oil company showed that it has sufficient production potential, and with the implementation of the proposed measures will achieve higher performance indicators.

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