IOP Conference Series: Earth and Environmental Science

PAPER • **OPEN ACCESS**

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To cite this article: T V Petrova *et al* 2017 *IOP Conf. Ser.: Earth Environ. Sci.* **84** 012039

View the article online for updates and enhancements.

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Use of the method for addressing the challenges of resources procurement management at a mining enterprise

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Abstract. The article is devoted to the analysis of possible application of the total cost of ownership method for the purchase of resources at a mining enterprise. The description of the total cost of ownership method and experience of using this method in other spheres is provided. The article identifies the essential components needed to calculate the total cost of ownership of a resource. Particular attention is paid to the ratio of the price of the purchased resource and the total cost of ownership. To justify the relevance of application of this method at a mining enterprise for resources purchase, the technical and economic conditions of mining enterprises have been analyzed, which are quite specific and force to introduce certain adjustments to the application of the considered method and opens up new possibilities for its use. Specific spheres for application of this method at a mining enterprise are determined. The main result of the study is the proposed practical recommendations for the introduction and extension of the practice of using the method when a mining enterprise purchases resources.

1. Introduction

In the system of procurement of material resources at enterprises, various competitive procedures are currently widely used, the essence of which is to identify proposals with a minimal price, quality of the acquired item of fixed assets, auxiliary materials and acceptable terms of delivery. However, today as an alternative to a price-based approach the method oftotal cost of ownership (TCO) is increasingly being used (also the term “concept” is common in the literature).It is assumed that the purchase price is only the “tip of the iceberg”, a visible part of the costs that the company incurs in connection with purchases. Orientation to the price only may, in the end, entail higher aggregate costs [1].

An exact, unambiguously understood definition of the concept of “total cost of ownership –TCO” does not exist. In some sources under TCO a methodology designed to determine the cost of information systems (and not only) are understood, which are calculated at all stages of the life cycle of the system, in others – the amount of direct and indirect costs incurred by the owner of the system over the lifetime [2].

It is believed that the term TCO was introduced in 1987 by the American consulting corporation Gartner, Inc. – the world leader in the field of independent information technology analytics, development problems of their strategic planning, development and effective application [3].

There are also alternative views on the authorship of the concept “total cost of ownership”. For example, in [4] it is stated that the very concept of TCO arose much earlier: The administration of the American Railway Engineering Association (1929) refers to the total cost of ownership in its financial records.

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The essence of TCO analysis is the study and evaluation of not only the price paid for the resource itself, but also the costs arising from the acquisition, use, and utilization of the purchased resource. In the field of procurement, the price is only a part of the total costs incurred by the enterprise. In addition to the price, it is necessary, at least, to take into account the cost of acquisition, operation, maintenance of the purchased resource, its service life, costs associated with its disposal.

Due to the application of this method the enterprise has the tool to assess its purchases not from the point of view of short-term benefits (acquisition at the minimum price), but from the point of view of long-term benefit (acquiring a resource with a minimum total cost of ownership).

The method of determining the total cost of ownership is widely used to carry out capital investments, acquisition of durable objects, auxiliary materials. The greatest spread of TCO is observed in the field of IT technologies – determination of the total cost of information systems, software products, which is confirmed by the publications on this topic.

For example, in [2] it is said about the relevance of the use of TCO method for the field of automation: it is necessary to know the possible cost of TCO, since this allows the structure and level of costs to be determined in advance, as well as to analyzed and correlated with the real capabilities of the potential user.

It is also noted in [3] that "the concept of TCO is applicable to any asset of an enterprise".

More often than not, companies spend most of their efforts on lowering purchase prices, and ignore spending in other areas – and they may be comparable to procurement prices, or even an order of magnitude higher. Only having a clear idea of the total costs, the company, while making important decisions, will be sure that reducing costs in one area will not lead to growth in another. Moreover, companies that do not estimate total costs do not use most of the potential opportunities to cut costs (not related to purchase prices) [1].

In the total cost of ownership quite a lot of components can be included, as an example, the following can be specified:

- cost of delivery;
- cost of recycling or income from resale, depending on the condition of the resource;
- internal costs of the enterprise, for example, for personnel training, for re-engineering.

From the supplier's point of view, the use of TCO allows the profitability of the services or products offered to be proved and partnerships with its customers to to be developed. Therefore, it can be argued that the need to determine TCO is relevant not only to the resource purchaser, but also to the supplier.

2. Results and discussion

The world leaders in the production of equipment for mining industry are focusing their attention on reducing TCO for their consumers, which underlines the urgency of applying this method. For example, CUMMINS Inc. announced a number of initiatives aimed at reducing TCO engines. "Faced with challenging economic conditions, our customers are keenly focused on conserving cash and optimizing equipment operation. Over 60 percent of a miner's TCO is tied to fuel, parts and service, and we have developed solutions which can be applied in a wide range of mining applications" [7].

In the mining industry TCO is used for the analysis of ownership cost of fixed assets. For example, in [8] it is noted that "in SUEK OJSC the choice of vehicles for transportation of rock mass is based, inter alia, on the analysis of total cost of ownership taking into account the individual mining and geological conditions of the enterprise and the specifics of the supplier's services. Calculations show that in conditions of SUEKOJSC it is more efficient to use less reliable but much less expensive equipment. For example, the cost of ownership of BelAZ-131 dump truck is 26% lower than the similar one of Caterpillar".

The TCO method is useful when purchasing durable materials from a mining enterprise. Conveyor belts, ventilation pipes, anchor fastening elements – these are examples of such materials. Purchase of such material and technical resources in most cases is now carried out through competitive procedures based on the minimum purchase costs.

In mining industries the use of TCO method is possible, both at open-cast mining enterprises and at enterprises with underground mining. In this regard, it can be noted that in general in 2015 in the structure of the cost of 1 tonne of coal the material costs made 44.8%, in 2014 – 42.3% [9]. Therefore, the task of optimizing the material and technical supply, including in the field of the criteria used for selecting competitive procedures, is very relevant.

At open-cast mining enterprises TCO method can be used for the purchase of fuels and lubricants. As an example, lubricants for quarry engines can be considered. Shell estimates [10] that 47% of mining companies do not believe that better lubricants can reduce maintenance costs, but 56% of companies recognize that unplanned shutdowns over the past three years have been associated with the wrong choice of lubricants.

For the correct identification and analysis of TCO it is necessary to develop a sequence of operations to be carried out. For example, in [11] the algorithm given in figure 1is offered.

Figure 1. Process of TCO identification and analysis.

To determine the formation of costs and identify the most significant elements of costs it is necessary to study the process of receipt, use, disposal of the resource which is depicted in figure 2.

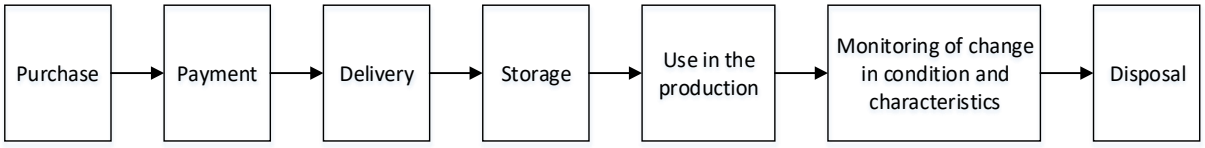

Figure 2. Life cycle of the purchased resource within the enterprise.

Thus, it is possible to form the list of costs on the basis of which TCO will be assessed. As an example, the application of TCO in the field of lubricants for mining equipment can be considered. Properly selected oils can have a significant impact on the service life of components, maintenance costs and unplanned downtimes, so they can help reduce costs more than the price of the lubricating oil itself.

The effective lubrication in the engine plays an important role in the protection of expensive equipment, since it can minimize downtime due to frequent oil changes, maintenance or even failure of individual equipment components.

In this case, the evaluation based on the following components can be performed:

- costs for selection of the required oils;
- costs for the purchase of oils, preparation of documents for the resource purchase (based on the retro information on the quality of the document circulation of the supplier in a temporal aspect and correctness);
- directly the cost of oils;
- costs for delivery and storage;
- costs for disposal;
- labor intensity and labor remuneration for oil replacement;
- cost of equipment downtimes during the oil replacement;
- cost of materials used for oils replacement;

- costs associated with the loss of quality by oil over time (increase in the fuel consumption).

As noted in [12] the main issue in the TCO estimation remains the problem of identifying and quantifying the most important components of the total cost of ownership with respect to a particular object. And this is due, first of all, to the fact that the number of indicators that might be taken into account when estimating TCO can reach several dozens.

Of course, not all these costs can and should be appropriately identified and evaluated, so the most significant of them must be used.

An analysis of the possibilities of applying TCO method has already been carried out with regard to the purchase of conveyor belt by V.V. Bushuyev [13]. The author suggests usage of the division of costs for the direct purchase of conveyor belt and operating costs. Operating costs include:

- costs for preventive maintenance;
- electricity costs;
- costs for installation and dismantling of conveyor belts;
- costs for elimination of failures consequences.

The author concludes that the total cost of ownership is a modern method for assessing the effectiveness of acquisition, ownership and operation of equipment and components and can be used to conduct competitive procedures.

However, the potential of TCO method is not limited to a conveyor belt, as noted in the table 1.

Table 1. Groups of auxiliary materials for which the use of TCO method is advisable.

Mine 1			Mine 2		
Auxiliary materials	Amount, thousand rubles	%	Auxiliary materials	Amount, thousand rubles	%
Pipes, metalware, isolation valves	12 315	5.7	Pipes, metalware, isolation valves	11 270	4.3
Roof bolts	17 822	8.3	Roof bolts	14 495	5.6
Conveyor belt	15 049	7	Conveyor belt	22 371	8.7
Wood materials	4 188	2	Wood materials	4 766	1.8
Spare parts	29 555	13.7	Spare parts	44 309	17
Metal and-metal products	10 259	4.8	Metal and-metal products	17 791	6.9
Steel support	44 910	21	Steel support	34 516	13.3
Electro-cable products	32 397	15	Electro-cable products	29 485	11.4
Fuels and lubricants	5 422	2.5	Fuels and lubricants	5 366	2
Other	43 381	20	Other	74 033	29
Total	215 298	100	Total	258 402	100

For underground mining it is possible to use TCO for the materials indicated in the table which reflects their share of costsin the composition of material costs for 2013.

Nevertheless, TCO method is critically evaluated by the author of the paper [14], which indicates that the existing methods differ in the composition and classification of the accounted cost items, methods of quantitative assessment of values of each cost element, and a number of other features. In addition, for all known approaches to TCO calculation, the following drawbacks are typical:

- existing methods do not give unambiguous recommendations on how to allocate a subset of the determining costs for specific conditions and objects;
- there are no well-founded procedures for obtaining quantitative estimates for individual cost items;
- the results of calculations for similar objects obtained by different methods for TCOestimation vary significantly;

- when using expert assessments, there are no clear and well-grounded procedures for conducting a group examination, procedures for coordinating expert opinions, which make it possible to improve the accuracy of calculations;
- does not take into account the dynamics and random nature of individual items of costs.

In addition, procurement managers do not have comprehensive information and knowledge to cover in full the characteristics and properties of all purchased auxiliary materials.

3. Conclusions

In connection with the above analysis, for the wide spread of TCO method enterprises need to solve the following tasks:

- generate a list of significant costs for each group of auxiliary materials, fixed assets purchased by coal-mining enterprises;
- create a universal algorithm for determining TCO supplementing it with specific requirements for each group of auxiliary materials;
- based on the algorithm to develop a calculation forms for rapid and accurate determination of TCO.

Creation of aworking algorithm and maintenance of the information base in an actual state will considerably simplify and increase the effectiveness of not only the activities of procurement structures and procurement procedures of the enterprise, but will also increase the efficiency of the entire enterprise.

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