

Selection of shaft sinking method by Fuzzy VIKOR approach

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ABSTRACT

Shaft sinking is one of the main parts in underground mine planning. Shaft has various applications in underground mines e.g. minerals exiting flow, gases entrance or exit way, stope developments for exploitation, etc. Considering that this section requires an abundance of expenses, management always following the election is the way that both terms have the technical considerations, economic constraints are also considered. Therefore, selecting shaft sinking method is one of the biggest concerns of underground mines management. There are some methods for this purpose including Delphi, ELECTRE, TOPSIS and VIKOR. This paper intends to use VIKOR method under fuzzy environment in order to choose a ventilation shaft sinking method for Parvade mine located in coal zone of Tabas. The results indicate that RBM method is the most preferable method.

Keywords: Shaft sinking, Tabas Parvade mine, Fuzzy VIKOR, Selection

INTRODUCTION

Shaft sinking is an important operation in mining for reaching and working mineral deposits situated at a depth below the surface, whenever the topography does not admit of driving adits or tunnels [1]. Shafts are the most important of the deep ore bodies' openings which are used to have access to ore bodies and serve the underground operations. These services include ventilation flow, minerals transportation, equipment and personnel transportation, power providing sources like electricity, compressed air, and communications, providing water and dewatering from mine [2]. In addition to sink new shafts, deepening available shafts is also desirable in this field. Shafts are usually circular or rectangular and are generally lined with wood, masonry, concrete, steel, or cast iron [3].

The sinking plant, usually temporary, comprises a small hoist and boiler, several buckets or sometimes a skip, one or more sinking pumps, according to the quantity of water, occasionally a small ventilating fan, and a timber derrick or head-frame over the shaft mouth, with appliances for dumping the buckets, handling the rock and safe-guarding the men in the shaft against falling objects [1].

Various shaft applications in underground mines has made shaft sinking one of the most essential parts in underground planning and it is one of the major concerns of mine designers and managers to decide on an appropriate method for shaft sinking. The most desirable method is one which considers all technical and environmental issues and has the minimum cost. Decision making on choosing the best shaft sinking method gets more complicated as all quantitative and qualitative

criteria impact on the sinking method selection and these criteria are often in contrast with each other.

Multi attribute decision making methods like VIKOR is a beneficial approach in decision making problems which can evaluate quantitative and qualitative criteria and sort the preferences. On the other hand, due to uncertainties in data collection, these uncertainties should be used therefore fuzzy theory must also be used in making decisions. Fuzzy VIKOR methodology is used in several researches. Wang, Liang, & Ho (2006) suggested multi-criteria decision analysis by Using Fuzzy VIKOR [4]. Huang, Yan, & Qui (2009) developed research on supply-chain-based logistics service capability by combination weighting method and fuzzy VIKOR algorithm [5]. Moeinzadeh, & Hajfathaliha (2009) developed a supply chain risk assessment approach based on the analytic network process (ANP) and the VIKOR methods under the fuzzy environment [6]. Sanayei, Mousavi, & Shahmirzadi (2009) developed a multi criteria decision making model based on the fuzzy VIKOR approach to help organizations in selecting knowledge portal system [7]. Kaya, & Kahraman (2010) performed both classical VIKOR and classical AHP procedures under fuzzy environment, they used this integrated methodology to the selection of the best energy policy and production site [8].

Therefore, this paper has tried to apply fuzzy VIKOR in order to help decision making on the type of shaft sinking of Parvade mine in Tabas coal zone.