Introduction of mining equipment: key factors for sustainable development

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1. Introduction

The mining industry is increasingly confronted with the social pressures asking for enhanced respect of environmental, ethical, social, and safety considerations. Furthermore, economic pressure coming from shareholders is adding complexity to the decision framework of any day-to-day mining operation. In response to these non-economic and economic requests embracing sustainable development concept, the purchase of innovative equipment was a solution favored by the companies of this sector. However, the introduction of these bigger, more powerful and partially automated equipments does not guarantee gains, particularly in productivity and in occupational health and safety. The aim of this study is to develop a model to identify the key factors contributing to the simultaneous increase of the sustainability (particularly in regards of workers' health and safety) and efficiency (operation costs) of a mine introducing innovative mining equipment.

2. Method

To answer this aim, a case study was conducted in an underground mine in Québec. Ten innovative equipment projects having been implanted at that mine since 2005 were analyzed. Each project has been evaluated on nearly twenty contextual and human factors, selected from an exhaustive review of the literature. Projects were also classified on their performance on four sustainable and efficiency indicators significant to the decision makers of the mine: the cost per meter drilled, the cost per hour of use, the availability ratio and the frequency rate of accidents. To identify which are the most relevant factors to explain the performance of projects on each indicator, we used a multiattribute decision aid method, known as the Dominance-based rough set approach DRSA. From the projects evaluation and classification, we made the extraction of decision rules such as "if ... then" allowing the simultaneous identification of the most relevant factors and the critical thresholds of these relevant factors to obtain various categories of performance.

3. Results

These decision rules pointed out the most relevant factors as well as their thresholds to improve efficiency and sustainability for the introduction of innovative mining equipment. For our case study mine, two factors were identified as the most relevant on all the four indicators: the required level of skill and the level of acceptance of the operators. Considering only the safety indicator, the quality of the seat and the experience of the operators showed themselves relevant to explain the results of the studied projects, while the level of standardization of the new equipment has proved relevant to explain the results in productivity.

4. Discussion

Managers of the mine where we conducted our case study should then give a particular attention on these key factors and on their critical thresholds to obtain successful implementations. Such a tool could also be useful for the managers in the selection of new equipment. By evaluating all the equipment prospects on the relevant factors, managers can have a good sight of which equipment is more likely to bring efficiency and sustainability. Better knowledge of key factors for introducing new mining equipment improve management decision making, which is the cornerstone to ensure the path of sustainable development is followed.
Key words: Mining equipment, innovation, management, sustainability, performance

References