Key Performance Indicators in the Extractive Industry

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Introduction

The mining industry is a vital economic sector comprising the utilisation of energy minerals, metal, and non-metal minerals (Onder et al., 2014). The continued world economic growth has led to a global intensification in demand for mineral raw materials. This tendency is pressuring the mining industry to do more, better and in a shorter time. If this pace takes place in a non-controlled manner, the consequences can be numerous, especially in terms of human occupational health and environmental consequences (Duarte et al., 2019). Regarding Industry 4.0, where digitalisation is under the light spot, the mining sites are monitored in a more accessible way than ever, and other areas such as risk assessment and management are being carefully analysed as well (Duarte et al., 2020). But how to determine whether the processes are within what is expected of them? The answer to this seems simple: Key Performance Indicators (KPI). KPI are self-explanatory: they consist of measuring criteria used for the operation assessment in terms of quality, efficiency, and efficacy (Coronado & Tenorio, 2015). These indicators are crucial for any organisation, and there are several which can be linked to different fields to measure the company's performance, such as economic, environmental, and even social (Murray, 2012). However, these indicators have to remain easy to use and understand, which can be often misleading.

The aim of this short review was to find evidence, within the literature, of the key performance indicators currently in use in the extractive industry.

Methodology

The Preferred reporting items for systematic reviews and meta-analyses (PRISMA) methodology (Moher et al., 2009; Page et al., 2021) was used to conduct this research.

The first step was to select the primary databases and journals and then apply the most appropriate keyword combinations.

"KPI" OR "key performance indicator" was sequentially combined with "quarry", "extractive industry", "open pit", "open cast", and "mining industry" in the Title/Abstract/Keywords field on Dimensions, INSPEC, Science Direct, Scopus, and Web of Science.

As exclusion criteria, the following filters were applied: 1) Document type (reviews were excluded), 2) Source type (only journals and trade publications were considered), and 3) Language (only English-written papers were considered). Afterwards, every title and abstract were assessed to determine the eligibility of the selected works and only papers providing case studies regarding the application of KPI were considered. The preliminary analysis focused on the study purpose, activity (or task), indicator(s), description, valuation, measurement method and limitation. This research was carried out in June 2021.

Results and discussion

The research provided 109 results. By applying the prior filters, 5 papers were removed due to 1) Document type, 1 was removed regarding 3) Language. No paper was removed due to 2) Source type. After reading the title and abstract of each work, 21 more papers were excluded because they were not within the proposed objective. From the remaining 82 records, 39 were duplicates; therefore, they were also excluded from the research. Additional 14 records had to be removed after not reaching the main author for a full-text retrieve. This led to a total of 29 records to full appraisal and discussion, after which more 15 papers were removed attributable to one (or more) of the following reasons: the article fairly mentioned KPI or did not actively state which or provide any other rationale. At the end of this analysis, 14 papers were included in this short review. Each paper was full-text appraised and divided into one of 8 key performance areas (KPA) categories. Figure 1 illustrates this classification.
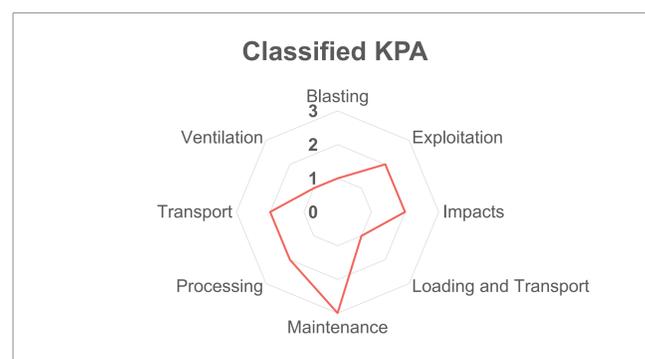

Fig. 1 – Key Performance Areas

Blasting (Cardu et al., 2015), Exploitation (Pantelić et al., 2013; Rybak & Włodarczyk, 2018), Impacts (Pitz et al., 2016; Sorensen, 2012), Loading and transport (system) (Voronov et al., 2019), Maintenance (Gustafson et al., 2013; Mutingi et al., 2016; Sharma et al., 2019), Processing (Dragano et al., 2019; Yu et al., 2016), Transport (alone) (Coronado & Tenorio, 2015; Upadhyay et al., 2020) and Ventilation (Nel et al., 2018).

The category of "Exploitation" was credited to papers referring to "mining" that do not subdivide their activities, and the category of "Impacts" included both Sustainability and Biodiversity.

Most of the referred KPI did not provide any description nor valuation concerning their applicability. Additionally, the measurement methods and the KPI's limitations were left out of the studies.

In general, each paper had its agenda, and the key performance indicators were just mentioned *en passant*, not leading to any particular conclusion

Conclusions

This short review aimed to identify the key performance indicators currently in use in the context of the extractive industry.

The information brought to life was divided and classified according to one of the eight defined categories for key performance areas. Despite the data survey, it was not possible to determine specific parameters such as valuation, description or even limitations.

It is important to state that the case studies analysed did not aim or were focused on the indicators themselves rather than their respective areas. The key performance indicators were used as a tool and not as the object and this fact might explain the lack of provided rationale.

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