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Application of building information modelling concepts in underground mining: a conceptual framework for a production zone

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ABSTRACT

Mines generate significant amounts of data, and the data are converted into information that can be analysed, therefore, it is essential that this information be used efficiently to aid in making appropriate decisions. Failure to acquire complete, accurate data timeously affects the downstream activities in a mine, consequently, affecting the quantity and quality of the production output. It was noted that mining companies do not use data and information efficiently due to challenges associated with mining companies accessing data sets that are incomplete, inaccurate, and delayed. Therefore, this study explored an efficient approach that can be utilised to ensure that mines can have complete and accurate data timeously. The focus of the study was on the production zone of an underground conventional mine. The production zone was selected because there are numerous interconnected activities that take place in this zone such as development, stoping, vamping, sweeping, and other logistics. The research objectives were to analyse the departments associated with the production zone of an underground conventional mine, to analyse BIM concepts, and to conceptualise a BIM-based framework for the production zone of an underground conventional mine. Data were collected from various departments involved in the production zone activities on Mine A through site visits. Furthermore, research related to the Building Information Modelling (BIM) technique was sought. BIM was analysed to determine its applicability in the production zone of Mine A. The key findings for the research study were that Mine A does not have a centralised information environment where the information is shared with the various departments to ensure data integrity. From a BIM perspective, Mine A is on BIM maturity level 0 as there is low collaboration between the departments. It was noted that Mine A can transition from BIM maturity level 0 to BIM maturity level 1 whereby there would be partial collaboration through a central information environment for the integration of information from the various departments on Mine A. A BIM-based framework for Mine A with the themes, digitise, interoperability, bidirectional services, high performance, and communication, was conceptualised to assist with utilising information efficiently, thus improving communication and collaboration on Mine A. For Mine A to efficiently use information, this research study recommended that middleware and data warehousing be used as integration techniques. The combination of the two techniques caters to the flexibility and ease of storing, managing, exchanging, and viewing information. It was also recommended that the Oracle Data Integrator Enterprise Edition and the Oracle Data Service Integrator be used as these two tools cater to the four themes identified in the BIM-based framework for Mine A. A backup system for the information generated by the mine was also recommended.