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Deutsche Industrie- und Handelskammer für das südliche Afrika
Southern African-German Chamber of Commerce and Industry

Making Industry 4.0 work for African mines (Mining Review Africa Webinar)
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The South African mining industry over the past decade has been characterised by declining productivity, poor lagging safety indicators, adverse environmental impacts and asset loss. The performance of the industry has further been adversely affected by the increased depth of mining (Gold and Platinum mines), volatility in commodity prices, currency fluctuations and more recently the Covid-19 global pandemic. Conversely, the global mining industry has seen improved performance both in terms of productivity and safety.

In recent years, the global mining industry has been investing in productivity enhancement through 4.0 technologies (digitalization and automation). This is seen as a major contributing factor to the recent improvements in operational performance. Strategically placed remote sensors, camera's and automated devices have been used to keep people out of harm's way, track assets, maximise utilization and monitor environmental impacts in what is known as a Connected mine.

In the connected mine, information is used to improve operational performance. The ability to see, in real-time, the location of mining equipment and mine personnel, the health status of mining machinery and equipment as well the performance of machines such as conveyor belts, crushers etc is critical. This is enabled by an efficient and reliable communication system that allows for the timeous transmission of data. Connectivity is essentially the nervous system on the Connected Mine and such can make or break the digital transformation on an operating mine or the implementation of 4.0 technologies on a new mine.

Traditionally, Wi-Fi networks were used as Access Points (AP's) for transmitting information in the digital mine ecosystem. However, Wi-Fi was initially not designed for mining environments. It typically offers between 30 and 100 connections per AP. The coverage range for each AP is between 50 and 100 meters and is characterised by a loss of up to 15 seconds in connectivity during the handover between different AP's. From a Latency perspective, fluctuations can be experienced for between 1ms and 2 seconds and its reliability of Wi-Fi networks decreases with an increased number of connections. Furthermore, Wi-Fi networks are susceptible to hacker attacks and intrusions and offer no IoT support and cannot handover to a public network. During operation, Wi-Fi networks require frequent configuration (up to 15 hrs/week) and this increases the operational expenditure for mines. Thus a mission critical wireless network is needed.

An alternative wireless network available in the market is a Private LTE network such as the one offered by Nokia. LTE networks have the capacity for 800 connections on a small cell and tens of thousands connections on an antenna. Their networks cover a range from 100m to 30 km (5-10 antenna needed) with predictable performance and reliability. They offer connectivity during mobility at speeds up to 350

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km/hr. LTE offers latency advantages- with fluctuations in connection limited to between 8 and 20 Ms. LTE networks are secure by design with minimal threat from hacking and intrusions and use the same technology as the one used in public 4G networks. They require 4x less configuration, management and maintenance as Wi-Fi networks thereby reducing operational expenditure. According to Mr Gary Conway (Nokia Head of Mining): "Connectivity beyond Wi-Fi is critical" and Nokia is doing business "with 4 out of 5 to miners globally". Their LTE network is available for both Surface and Underground mining where practicable.

So why hasn't the South African mining industry invested in 4.0 technologies at the same pace as the rest of the world?

One key reason identified by Sandvick is mine design and layout. The mining methods used globally in underground mines are massive mining methods that include Sub-level Caving, Block Caving and Vertical Crater Retreat Mining (to name a few). These mining methods, by design, have a static footprint which is suitable to digitalization and automation. Conversely, in South African underground mining, scattered mining methods are employed to allow for selective mining and most mechanized underground mines use the "Bord and Pillar" mining method. The footprint of these methods increases by nature or is dynamic by nature. Another reason for slow adoption is the fact that digital transformation is very difficult to implement on Brownfield projects and is easier to implement on Greenfield projects. There has been little to no exploration in South Africa in recent years and thus the opportunities to invest in 4.0 technologies have been limited. There are, however pockets, of excellence with some mines using 4.0 technologies in places as remote locations as Mali and in some open cast and underground operations in South Africa (e.g. Anglo Americans Mogalakwena and Sishen mines and Finsch Diamond mine).

So what is the solution for digital transformation in South Africa's mining Industry?

A phased approach may be the solution for digital transformation in South Africa's mining industry. Taking into account the inflexible nature of the labour market in South Africa and high unemployment, the first step in in the process is Digitalization and the second step is Automation wherever practicable. Change management will be critical in the journey and the availability of network infrastructure (spectrum)is key. Not all ore bodies can be mined by mining methods that are suitable for automation and mines need to define the destinations of their digital futures individually. Practicality has to be at the fore front of digital transformation planning for individual operations. Industry 4.0 can work in South Africa with the correct understanding of what can be and what can't be achieved, taking into cognisance the limitation imposed by orebody geometries and the availability of infrastructure. A flexible approach is the key to implementation.

Sources

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