Reaching for the Sky: Using Drones to Propel the Mining Industry Forward

Abstract

Drones are becoming increasingly pervasive across industries. Use of drones in the Metals & Mining (M&M) industry is currently centered on safeguarding human safety in risky and hazardous operations. Cost optimization is an area that is yet to be explored. The lack of solutions related to the commercialized use of drones can be attributed to multiple regulatory hurdles and technological limitations, besides the fear of increasing monetary investments.

The paper highlights various use cases and benefits of deploying drones in the M&M industry with the help of real world examples. It also discusses the key considerations for developing drone solutions and highlights a framework that can help M&M companies determine readiness, mitigate challenges, and maximize ROI on drone technology investments.

Is the Metals & Mining Sector Ready to Embrace Drones?

The M&M industry, which has traditionally stayed away from embracing technological advancements, is now banking on Industry 4.0 and associated technologies such as Cloud, Analytics, AI, and Internet of Things (IoT) to address a whole gamut of challenges. These include macroeconomic factors like price volatility, economic downturn, supply-demand fluctuation, stringent regulations, and environmental sanctions. At the same time, M&M companies are also looking to overcome microeconomic hurdles related to hazardous mining conditions to ensure the health, safety, and security of their workforce. One solution to this microeconomic challenge that is gaining prominence in recent times is the use of drones. While deep rooted drone solutions are yet to gain the support of the industry, many companies have started using drones to mitigate the risks arising out of hazardous working conditions at the production sites and mines. According to recent research, digitization in mining will cut down the number of mining fatalities by half by 2020[i].

How can Drones Transform the Mining Industry?

While drones offer significant applications across the different stages of the M&M value chain, their importance could vary depending on the companies' needs and the regions of operations. Figure 1 maps applications of drones in the M&M industry with varying degrees of importance.

In the figure, visual information includes surveillance, inspection, and compliance management. Site planning incorporates planning across the site for physical set-ups along with helping company leadership take important decisions. Site and surrounding inspection involves detailed analysis of the geographical regions. Mapping activities include 3D/4D mapping across mines and sites.

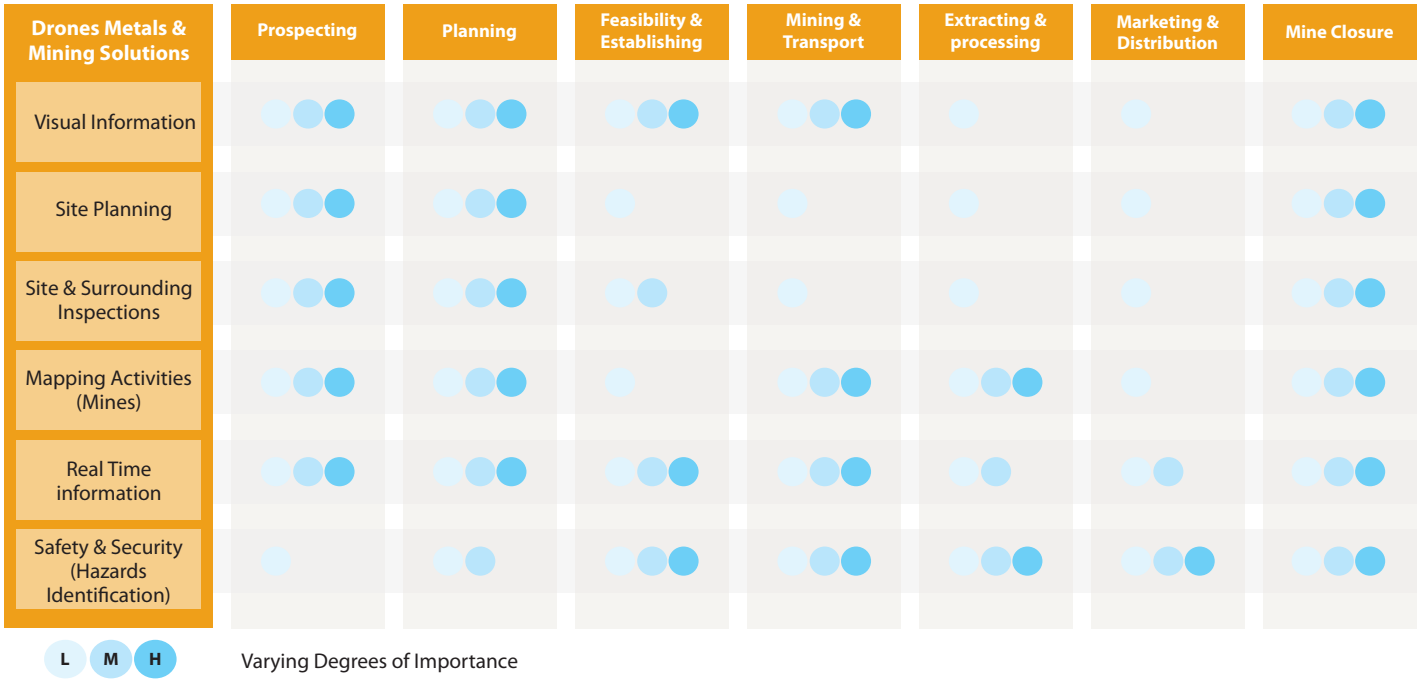

Figure 1: Drone-based solutions across the M&M value chain

Some of the key use cases and real world examples of drone usage in M&M industry include:

- **Improving safety during site inspections:** Australian mining companies use drones on a regular basis to collect information and collate data points from areas that are inaccessible or hazardous to human personnel.[ii] Automated aerial drones can help monitor and map such terrain in a digital format.

- **Enabling cost optimization through visual monitoring:** Ensuring safety compliance at a much cheaper price tag has emerged as one of the major advantages of drones in the M&M industry. BHP Billiton has been using drones in its Queensland mines. Originally, the drone cameras were intended to ensure safety and security of workers[iii] by serving as surveillance agents that ensure proper evacuation before beginning blasting activities. Today, they are being used by the company to drive cost-savings. Replacing planes with camera-enabled drones has saved the company AUD 5 million annually as hiring a drone pilot costs just USD 200 per hour as opposed to hiring a plane for USD 2,000 per hour.
- **Safeguarding equipment inspection and infrastructure surveillance:** Rio Tinto, a leading global mining group, is an avid user of drones. The company uses them to obtain real time 3-D mapping and information with respect to equipment instructions, along with surveillance data on slopes, walls, or crests[iv]. The company is now planning to expand the use of drone technology to other business aspects such as monitoring geo-technical issues in difficult-to-access areas, and inspection of long stretches of infrastructure such as power and rail lines.[v]
- **Mitigating the risk from illegal mining:** In Gujarat, India, drones with night vision cameras ensure tight surveillance of the Sabarmati river bed, where rampant illegal sand mining is eroding the profits of the mining companies in the region.[vi]
- **Accelerating data collection and boosting operational efficiency:** Anglo American, a globally diversified mining business, has been using a fleet of 10 drones to monitor the progress of work and stockpiles in their Kumba iron ore mines in South Africa.[vii] The drones have helped the mine operator collect data that previously would have taken weeks to collate, besides delivering new information from inaccessible areas that was not feasible before.

What's Delaying Drone Adoption?

Up until now, most drone solutions have been designed to provide only incremental benefits. They have failed to account for opportunity costs. The lack of a standardized adoption framework further complicates the situation for M&M companies struggling to define their uses cases and develop customized solutions for their value chains. Some mining companies are apprehensive about the increased upfront cost of operations and are unwilling to change status quo. Table 1 summarizes the key issues hindering large scale adoption of drones in the M&M sector.

Challenges in using drones in the M&M industry	Impact
Varying rules, regulations, and legalities across geographies	Lack of standardized global policies around drone usage results in strict vigilance by local law and enforcement agencies.
Drones have limited flying capacity, load endurance, and processing power	This has made the drones financially unviable, as their flying time is limited. In addition, their limited processing power prevents extensive real time information gathering and decision-making.
Drones solutions are incompatible with existing solutions	The existing solutions or the operating/environmental conditions may not be conducive to drone deployment.
Concerns related to public privacy and safety and air traffic interference	This is one of the main reasons preventing most countries from granting full or partial permission – currently drones need to stay in the line of sight at all times.
Lack of availability of experienced vendors and readily customizable solutions	Even if M&M companies are interested in deploying drone solutions, the implementation may become infeasible or incompatible due to lack of economies of scale.

Table 1: Reasons hampering large-scale adoption of drones in the M&M sector

All the above challenges or a mix of some of the challenges from above coupled with the crisis for the M & M companies in terms of commodity prices have posed hurdles. Yet examples & case studies have demonstrated that the mining companies are truly evaluating options for embracing the Drones solution to gain competitive advantages. However, the lack of framework or rather absence of a structured guide have often hindered the adoptions except some big names in the industry. Thus, the next section would try to present an exhaustive framework or rather a structured guide, which could help an M&M company to reconsider Drones as a part of their IT investments in the future.

Can V-A-C-A-R-B framework Assess M&M Companies' Readiness for Drone Adoption?

Leveraging the V-A-C-A-R-B (Validation across value chain, Analysis of acceptability, Compatibility check, Availability check, ROI determination, and Benefits realization) framework can help M&M companies understand the implications and impact of drone solutions beforehand, enabling greater profitability and cost savings.

V-A-C-A-R-B is a qualitative framework (as illustrated in Figure 2) that takes into consideration the different possibilities of addressing issues, which could prevent M&M companies from adopting drone solutions. This framework in conjunction with the Drone-based solution-mapping chart could help M&M companies to determine their compatibility, readiness, and acceptability of Drone solution across their value chain.

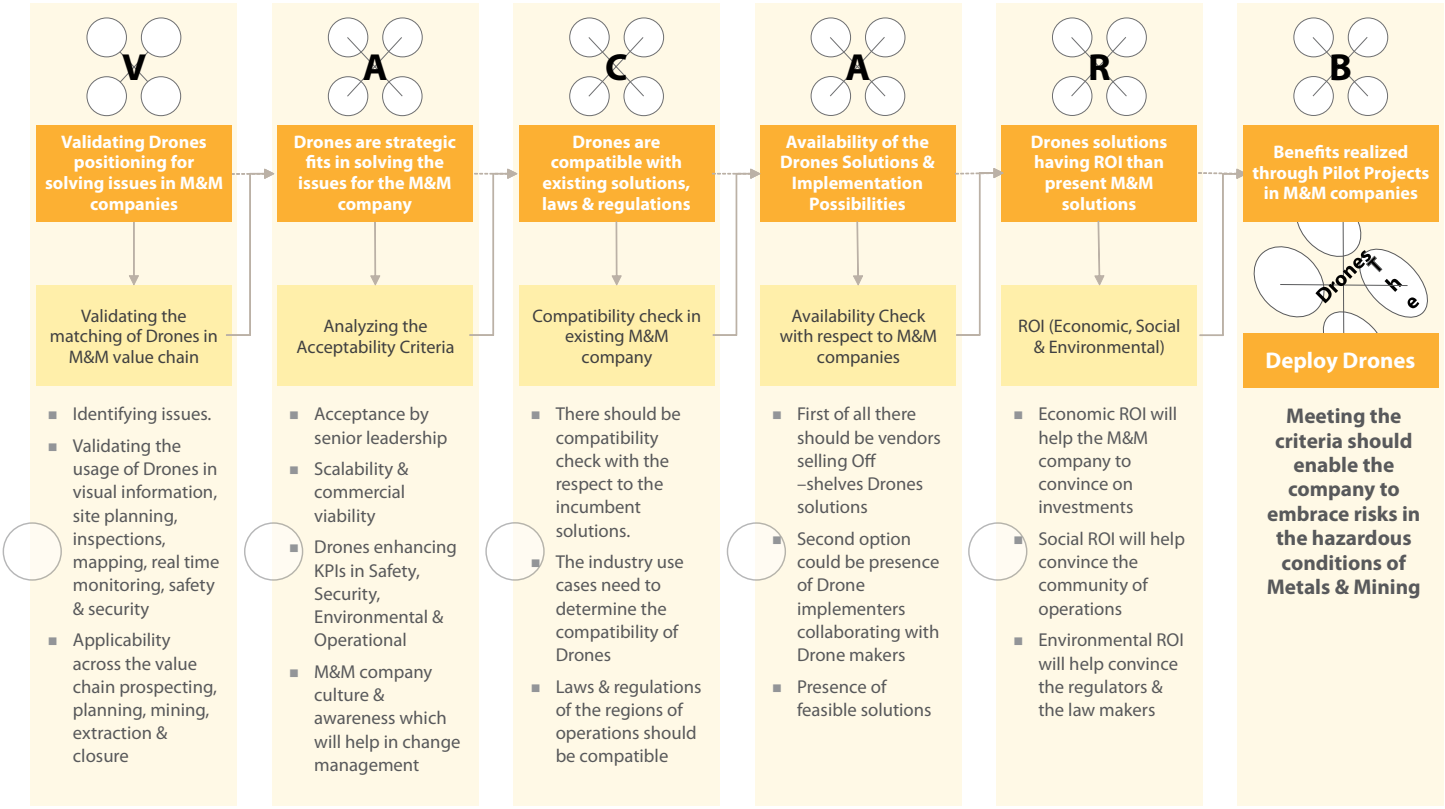

Figure 2: V-A-C-A-R-B framework to assess M&M companies' drone solution readiness

Will Drones Help the Mining Sector Soar into a Digital future?

After weathering a long-lasting economic downturn, mining companies are finally looking to the future with hope as economic conditions turn favorable and digital technologies promise unprecedented processing power. Drones enable high-

speed data acquisition, high level of accuracy and at the same time provide safety and security to the workers in hazardous conditions. This makes drones the ideal solution for increasing scalability, efficiency, and cost-effectiveness in surveying mining regions.

Understandably, M&M companies are eagerly lapping up the digital opportunity - 69% are looking to introduce remote operations of some kind, with 27% looking at using unmanned drones in the near future. According to the World Economic Forum, digitization could add USD 425 billion of incremental value by 2025[viii], which is nearly 3-4% of the M&M industry's current revenue. M&M players who harness the change to their advantage and future-proof their workforce and processes will be the frontrunners in the new digital reality. In this context, Drones act as multi-modal solutions for the M&M players as they not only promise cost savings but also help in ensuring safety and security along with increasing effectiveness of the operations.

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