



Gustavo (Gus) Gomes,
Director Ops/Technical
Global Iron Ore, Vale

Lifting the game in mining: the manufacturing view

If you have been in the industry long enough you would have already heard that Mining “is a different industry”: Mother Nature drives high variability. And not much can be done about it, justifying sub-performance in some operations.

It is true that, once ore is dug out, it carries intrinsic variability. Variable feed impacts the chain downstream – amplified by variable equipment performance, often due to quality of workmanship. Variable production results in high costs, sometimes driving “desperate measures” with cuts in maintenance schedules, purchase of cheaper quality parts. Cyclical supply and demands adds to the issue. And last but not least, “unpredictable” impact from weather events.

The result is a daunting sub-performance across some mining businesses, with production profiles often resembling an “electrocardiogram”. Heroic efforts are then necessary, with multiple changes implemented “on-the-go” to recoup from production lows. These often introduce further variability, making the situation worse – the (un) popular “Vortex” effect. Until it is too late – and a major turnaround is required.

CAN MINING LEARN FROM HARD-CORE MANUFACTURING?

Once discussing these issues with colleagues from other industries – car and aviation in particular – I got surprised to find out they also shared variability issues – variable material quality, equipment reliability, variable workmanship, supply chain disruptions, volatile market demand – to mention a few.

We then concluded that car manufacturing and alike could not afford – would flunk (and some did) without managing variability to perfection. Most run into a brutal competitive environment, surviving on razor-thin margins – contrary to most mining businesses.

If these issues are common to manufacturing, which had to furiously tackle these due to low (er) margins – can mining learn from them?

PERFECTING THE GAME

The good news is that best practices from manufacturing are being replicated across mining for some time, reducing

variability hence improving performance.

This includes, amongst others, better quality control of materials through enhanced OBK (orebody knowledge), blasts achieving optimum fragmentation, mine layouts and accesses for improved safety and equipment flow, predictive maintenance through monitoring of vibration and temperature, operational and maintenance practices simplified and disseminated through SOPs (Standard Operating Procedures). And last but not least – drive to automation, initially on separate segments, drills, trucks – until the full-chain is fully automated and self-optimised through AI (Artificial Intelligence).

PIT LAYOUT 2.0

One aspect from manufacturing that I find underestimated is the effect of layouts in overall safety and performance.

Some industries went to perfecting layouts and material flow including floor space, accesses, sequencing, making areas and equipment easy for traffic, inspections and interventions – with great positive impact in safety and productivity.

Mining have definitively evolved with better pit and shop floors developed in most operations. However it seems these developments are not widespread, with mining been slightly behind. This may not resonate to everyone – particularly the ones coming from operations that are exceptional on pit and shop floor performance.

One of my first exposure to optimised designs was back in 2000, US thermal coal – a razor-thin margin business. Most operations were running with opex at \$2/t, while mine gate price was at <\$3/t. Truck and shovel designs were perfected, with “modified drive-by” implemented and delivering optimum truck access, with practically zero lost time during the approach, and shovels with max 90° swings – both with huge impact on time-to-load. Wheel loaders were cycled and entered the shovel area between truck arrivals. The process was perfected to a point where the mine face literally became a “rock factory”, with huge productivity achieved, with opex

comparable to cost of prime for draglines.

Subsequently – and also in coal – I joined a challenging operation in Queensland. It had the highest stripping ratio (>12/1 bcm/t) and sub-quality metallurgical coal seams, carrying lower price and lower demand compared to neighbours. It was late 2008 – the GFC (Global Financial Crisis) was at its peak. Operation implemented an optimised dragline digging approach that ultimately increased prime move by 20%. Ideas from the shopfloor were harvested through groups of frontline operators including truck & shovel setups, haulroads, drainage, overall sequencing and alike. Despite all odds, this operation turned again profitable and had its life extended for years, overcoming tough times. Again – a combination of harvesting best ideas through clever layout designs, implemented by what proved to be a top change-agent team.

More recently I came across some (v large) operations struggling to meet production. Pit had enough space to implement a productive geometry, but changes “on-the-go”, chasing ore quality, led the sequence to be modified. Floor became fragmented in multiple benches, reducing the actual running space. Areas of lower quality ore were left behind, to be picked up “at a later stage”. Sumps had to be improvised in areas originally allocated to face access. Some accesses were set as single lane. Broken stock got reduced to a point leading to daily blasts, with huge pit disruption. The operation became highly unproductive, also a safety risk.

In this last example a “call to arms” led the team to bravely step backwards – getting “out of the Vortex” by re-establishing proper design with optimum flow, removing sub-benches, reclaiming areas of sub-quality ore, blending with others. Sumps were redug out of the way, allowing proper traffic flow. The intervention initially led to lower production – a “hard pill” to swallow. But in <6 months it paid off – blasts



Drive-by layout, Wyoming Coal – trucks positioned parallel to digging face, with no back-up drive required – operation became a “Rock Factory”, critical to survive in a razor-sharp margin business

went from daily 20kt shots to up to single 1Mt blasts, done only once a week. Pit geometry was re-established, with enough space to set double-lane accesses everywhere. Truck speed were safely increased. This operation is now overproducing – it went from a sub-performer to a leader in turnaround in its region.

WHAT IS NEXT?

The future is now, with mining capable of reaching a level of predictability at par with manufacturing – transforming itself into a controlled and predictable environment, without the ups and downs – where “heroes will be no longer required”.

Best practices are being replicated across the industry – Pit Layout 2.0 is just one of many – now becoming norm rather than exception – critical to performance and sustainability of an industry that provides seed and value creation to many others.

JOURNAL OF MINES, METALS & FUELS

Special Issue on

BAUXITE RESOURCES OF GUIZHOU PROVINCE IN CHINA

For copies please contact:

The Manager

Books & Journals Private Limited

Moon Plaza (2A, 2nd Floor), 62 Lenin Sarani, Taltala, Kolkata 700013

e-mail: bnjournals@gmail.com; pradipchanda@yahoo.co.uk;

www.jmmf.info • Mob: +919239384829 / 9903463829