"Optimising Grinding Circuit Performance: A Success Story at Harmony Gold's Hidden Valley Mine with Rockwell Automation’s Pavilion8TM MPC Process Optimisation technology" A Jain, T Tlhobo, L Silva and F Anis

1 Lead Advanced Process Control Engineer, A Jain, Rockwell Automation, Perth, WA, 6103 Email: akhilesh.jain@rockwellautomation.com

2 Processing Principal, T Tlhobo, Harmony Gold, Milton, Queensland 4064. Email: teboho.tlhobo@harmonyseasia.com

3 Senior Process Control Engineer, L Silva, Morobe Consolidated Goldfields Limited, Papua New Guinea. Email: [leonardo.silva@harmonyseasia.com](mailto:leonardo.silva@harmonyseasia.com)

4 Metallurgy Superintendent, F Anis, Morobe Consolidated Goldfields Limited, Papua New Guinea. Email: fred.anis@harmonyseasia.com

Keywords: Model Predictive Control, Advanced Process Control, Predictive Control, Milling Optimisation, Process Optimisation, Real Time Closed Loop Control, Pavilion8, Automation

# ABSTRACT

Harmony Gold Mining Company Limited, a distinguished player in the gold mining and exploration sector, sought to enhance its operational efficiency and sustainability at the Hidden Valley Mine in Papua New Guinea. In collaboration with Rockwell Automation’s industrial data science team, Harmony Gold implemented Factory TalkTM Pavilion8TM Model Predictive Control (MPC) in the SAG mill grinding process, showcasing a commitment to safe, profitable output through operational excellence.

The goal was clear: optimise the grinding circuit to achieve increased efficiency, throughput, and stability in SAG mill operations while ensuring consistent cyclone feed pressure. Facing challenges of ore variability and rising sustainability expectations, even a seemingly small increase in throughput can have significant positive effects on costs, efficiency, and productivity.

Engaging Rockwell Automation, Harmony Gold embarked on a comprehensive approach to optimise mill throughput and reduce process condition variability. The Rockwell Automation MPC team analysed 12 months' worth of historical data, identifying critical process parameters amenable to control and modification. Leveraging multivariable control, constraint handling, feedforward, decoupling, and dead-time compensation, Pavilion8 MPC Controller employed process models for optimised control actions.

The dynamic correlations within the grinding circuit were effectively managed by MPC by adjusting mill parameters such as mill speed and cyclone feed pump speed. MPC system achieved maximum achievable throughput while adhering to operational constraints such as power consumption, ore variability and availability. Pavilion8 also maintained stable cyclone feed pressure, reducing variability, and ensuring consistent cyclone operation.

Results exceeded expectations, with the MPC Grinding Circuit Application designed, implemented, and validated in less than six months. The project surpassed the initial throughput targets, achieving 20 per cent better than target improvement reduction in milling variability after a 30-day run, and more than double the target improvement over 221 days. Pavilion8 reduced the variability in feed rate by 35.1 per cent.

Additional achievements included a robust 90.8 per cent MPC uptime, indicating strong acceptance from operations, and consistent precision in maintaining mill weight closer to the target, a 41.2 per cent reduction in deviation from the target. The application sustained cyclone feed pressure within the desired range, displaying an 18.6 per cent reduction in variability compared to baseline performance. These milestones underscore the substantial impact and effectiveness of the Pavilion8 MPC Grinding Circuit Application at Hidden Valley Mine.

This success set the stage to rollout MPC technology into the rest of the processes, where there is opportunity to reduce variability and optimise productivity. The collaboration between Harmony and Rockwell Automation marks a continued commitment to operational excellence and sustainable mining practices.