



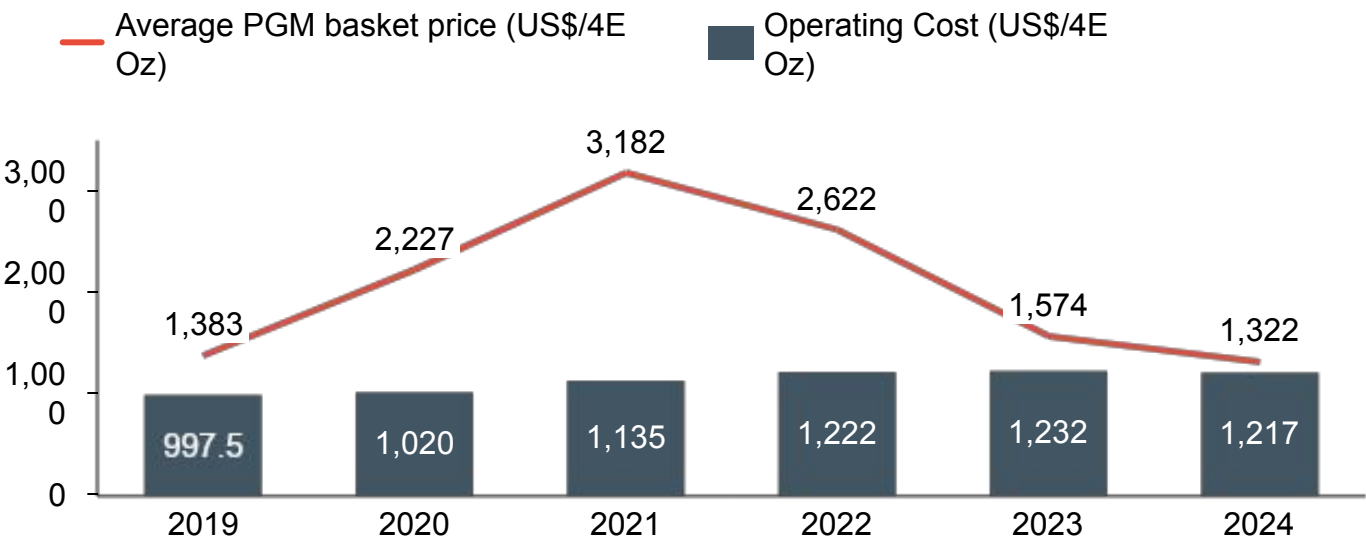
Optimizing PGM Value Chains Through embracing Lean Six Sigma Principles

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Navigating Volatility: Why Operational Excellence Is No Longer Optional in the PGM Industry

1. PGM 4E Basket Price Volatility and Operating Cost



PGM Basket Price Volatility

Fluctuating basket price due to various macro-economic factors including:

- + Supply Disruptions
- + Industrial and Investment demand



Operating Costs

Increase in the operating costs due to impacted by:

- + Weakening local currencies
- + power shortages, labor unrest, and aging infrastructure

2. Supply Chain Fragility

- + Inventory Backlogs and Destocking
- + Economic Pressure and Rationalization
- + Geopolitical and Trade Risk
- + Recycling and Secondary Supply Risk

Source: 1. Sibanye Stillwater Annual Integrated Report (2020-2025) | 2. Impala Platinum Annual Results (2019-2024) | Hatch Analysis | 3. Johnson Matthey: PGM market report – May 2025 | Anglo American Platinum: Capital Markets Day 2025

Lean Six Sigma Principles for Achieving Operational Excellence

	 Lean Management	 Six Sigma	 Lean Six Sigma
Definition	<i>Elimination of waste and flow improvement within production</i>	<i>Reduction of process variation and defects using statistical method</i>	<i>Combines Lean's focus on speed and waste elimination with Six Sigma's focus on quality and variability reduction.</i>
Key Principles	+ Define value + Map the value stream and eliminate waste. + Continuous improvement	+ DMAIC cycle (Define, Measure, Analyse, Improve, Control) + Data Driven + Clear, structured approach scalable across industries	+ Lean improves flow and reduces waste. + Six Sigma ensures process consistency and quality.
Strategic Benefits	+ Reduced costs and lead times. + Improved quality and productivity. + Lower inventory and fewer defects.	+ Improved process stability and quality. + Reduced defects and rework. + Alignment with business goals.	+ Faster, more efficient processes. + Greater cost savings and profitability. + Stronger cross-functional collaboration. + Cultural shift toward continuous improvement and excellence cycle

Source: The application of Lean Management and Six Sigma tools in global enterprises | ThinkSIGMA : Implementation of Lean Six Sigma in the Mining Industry | Lean Production in Mining – I2Mine Project

Applying Lean Six Sigma Across the PGMs Value Chain

Most players in the PGMs sector are vertically integrated and this will bring

01. Waste Elimination and Process Optimization

- + **Value Stream Mapping:** identify sources of waste and eliminate (or drastically reduce)
- + **Process Streamlining:** create smoother, faster, and more consistent processes that deliver value

02. Quality Control and Variability Reduction

- + **AI-assisted Process Control (AIPC):** embedding AI in the monitoring of key variables in production
- + **Regression Analysis:** Links variability of processes to their inputs

03. Asset Maintenance and Reliability

- + **Pareto Analyses:** Prioritisation of the top 20% of the issues causing 80% of the down time
- + **Standardise Procedures:** Checklists and visual management improve consistency in repairs

Deep Dive

An opportunity to unlock operational excellence across the PGM value chain—transforming isolated processes into an optimized, vertically integrated system.

Using Lean Six Sigma for Optimizing PGM Processes Across the Value Chain for Cost Resilience



Mining



Concentrating



Smelting



Refining



Marketing

1

Define Value

- + **Goal:** Deliver high-purity platinum sponge within a defined lead time.
- + **Customer Perspective:** Purity, consistency, and delivery time are key value drivers.
- + **Operational Perspective:** Efficiency, cost control, and minimal waste.

2

Process Mapping & Valuation

- Visualize the entire production flow from raw material input to final, assign a value to each and classify as:
- + **Value-Adding (VA)**
 - + **Non-Value-Adding (NVA)**
 - + **Necessary but Non-Value-Adding (NNVA)**

3

Process Streamlining

Interdependencies:

- + Are NVA steps co-dependent or on VA steps?
- + Do delays in NVA steps cascade into others?

Reduction/ Elimination:

- + Can one apply automation / digital tools to reduce manual NVA steps ?
- + Will layout redesign eliminate bottlenecks?

4

Implementation & Sustainability

- + Apply changes
- + Use Kaizen events or DMAIC Improve phase for structured rollout
- + Monitor KPIs (lead time, cost per 4E oz, purity).
- + Standardize new processes and train teams.

This approach delivers measurable gains—lower costs, faster throughput, and improved quality across the entire PGM value chain.

Connect with the Hatch Team

Advisory

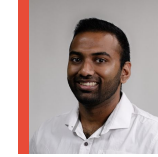
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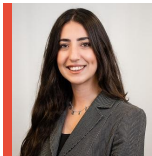
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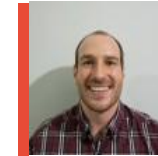
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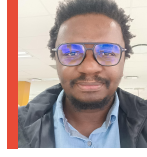
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Q&A

For more information,
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