The implementation of automated Power BI reporting at the Anglo American Platinum smelting operations

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Anglo American Platinum sought to fulfill a key requirement in its digital strategy through the implementation of automated reporting throughout its business. The smelting division – consisting of four different smelters and one converter – underpinned this goal through the use of Power BI. Power BI was developed by Microsoft to enable organisations to report and visualise data and delve into the key insights influencing organisational performance. The smelting operations have developed a number of reports using this tool to visualise data. Previously, the reporting required the manual download and manipulation of data into the required reporting formats. The focus of this paper is the description of the adoption of the new reporting system in line with the digital strategy, as well as the associated benefits and challenges experienced. The development of the reporting spanned over various departments and functions such as production, engineering, safety and the technical and technology realms. Various case studies at the operations are discussed in line with the reporting strategy with the intention of driving the culture of data-driven decision making. The benefits lie in the availability of data, standardisation of systems and data handling procedures, and the reduction of human error in the collation of data resulting in users spending additional time on the data analysis rather than the collection thereof. Challenges experienced included the relevant infrastructure availability, skills development and the required culture shift required to adopt the new systems. The manner in which these challenges were addressed and the future development are also discussed.

INTRODUCTION

Technology is transforming at a breakneck pace. Advances like artificial intelligence, machine learning and big data continue to transform the way we communicate, work, market, and make decisions. A key focus point to improve operational efficiency and production is the automation of reporting. As the Anglo American Operating Model has gained momentum throughout the Anglo American Group, there has been a clear drive to enable best practice across the entire processing division through a common data-driven approach to reporting and oversight. Through technology, the move from people to system dependency enables a common understanding of the requirements to manage, operate and oversee production.

The focus of the paper will be primarily based on the implementation of Power BI at the different smelters across varying departments and functions. In addition, the advantages, benefits and challenges experienced through the implementation thereof will be described. A further description on the impact of the training required and the systems in place going forward to ensure continuous use of the tool will be discussed.

Anglo American's value of innovation can be fulfilled through exposing personnel to new systems and upgrading their relevant digital skillsets. When employees know how to use these technical tools (and all their features) correctly, they are likely to be more efficient in ensuring that more work is completed in less time with fewer resources and increased quality.

The purpose of developing reporting within the operational framework is to provide critical insights into the health of the business at varying levels to provide management with a detailed and compelling view. Another purpose includes the process of compiling data, ensuring data integrity and allowing for review of information in specific departments and areas, as well as the development of key performance indices (KPIs) for measurement and monitoring.

Context and History of Reporting
Historically, data capture and collection consisted of the manual collection of data through log sheets and the manual downloading of data from PI historians into Microsoft Excel spreadsheets. These data sets were subsequently used in the problem solving, monitoring and predictive calculations, trend analyses and official reporting of the sites and central functions. Subsequently, some of the KPIs were monitored through the use of SQL Server Reporting Services in a tabulated format for daily monitoring. Albeit effective at the time of development, a greater focus on the data led to the need for a more robust and versatile system.

The smelting division of Anglo American Platinum is made up of four different smelters – Waterval, Polokwane, Mortimer and Unki smelters – and a converting process. In order to achieve the goal of reporting automation, the leadership team sought to develop a reporting strategy at all levels of the smelting operations that would seek to reduce the time, preparation and resources required for reporting in a consistent and standardised manner. The reporting automation process was further required to ensure that the data handling was consistent with high quality and availability. This would further enable the processing sites to ensure that the decisions taken were data-driven.

There has been a significant evolution of data handling and reporting over the years through the technological advancements made. In earlier years, data and/or information collection in the processing environment consisted of data log sheets with some of the data transferred to information in Excel sheets for purposes which include problem solving, monitoring and predictive calculations, and trend analysis for decision making and reporting.

Subsequent advancements in instrumentation, data, technology and digital storage allowed for continuous data monitoring. This was captured with the intention of processing the data and generating information at a future time. Since the sampling intervals of this data were significantly more frequent than the previous log sheets (discrete data points), a PI Historian was set up to capture the continuous data points accordingly. The data was sampled at a 10 second frequency, unless otherwise specified, due to the increased speed of digitisation and measurement of continuous process variables.

The resultant expansion in the amount of data available led to the question of how to utilise data effectively. The continuous data could effectively be represented at the base frequencies or be rolled up to provide the information for hourly, daily, weekly and monthly metrics. There was a lack of understanding of the tools to translate this data into usable information, leading to dependence on older tools such as Microsoft Excel to achieve the required outcomes. In addition to the possible risk of different methods of data retrieval and calculations, various problem-solving and predictive calculations, monitoring, trend analysis and reports were and are still performed in Microsoft Excel, with some degree of success.

The continuous data is also extracted selectively to reduce the size of the spreadsheets to prevent overloading the processing computer and to prevent damage to the files. Due to inconsistencies in these methods, compromised information quality was flagged as a risk. In addition, the nature of utilising spreadsheets for the tasks required, the calculations, monitoring, trending, and reporting files were stored in a public share drive or a personal computer and as a result were not subject to data governance

procedures. The resulting security risk remains a challenge with no additional digital security layers placed on the access of the data.

As a result of the collaborative nature of the analyses being done, the files are further allowed to be edited and changed to different time periods and different analyses. In transitional situations, these can then lead to inaccuracies if new users and owners do not understand the intrinsic development of the sheet. In some cases where the files were corrupted or misplaced during a transition period, different or new spreadsheets were created to replace or overcome these previously encountered glitches without necessarily following the original purpose of the spreadsheets. This poses a significant risk of resource wastage and multiple workstreams to achieve the same output.

When the need arises to roll the information up into a common report for central functional performance evaluations or reporting purposes, it is typically found that the applied data collection strategies and calculations are inconsistent and, in some cases, incorrect. Since reporting is a routine task and the spreadsheets are ungoverned, resources often allocated to rework and re-write Microsoft Excel sheets.

Power BI

Power BI is a reporting and business analytics tool employed by Microsoft to visualise and develop insights from an organisation's data. It can be utilised to connect multiple data sources and generate dashboards and reports. A Power BI report is a multi-outlook view into a dataset, with visuals that represent diverse findings and insights from that dataset. A report can have a single visual or pages full of visuals. These tools are discussed in Table I. Data can be imported from a database or queried directly from the source. These data sources could be sourced from individual files (e.g. Microsoft Excel or a CSV file), databases (including SQL or Microsoft Azure) or from web connections such as Smartsheet.

The advent of the digitalisation strategy of the company was encompassed by the smelting division embarking on a journey of identifying key operating regions where data and information based on the data required manual intervention, and where there was a delay in the collation of said data. This led to the smelters adopting the use of Power BI as a mechanism of collating, standardising and reporting of data. The mission is to ensure that consistent and reliable reporting is delivered to site consistently, with high availability to ensure that the sites have the capability to make data-driven decisions.

Power BI was introduced to the smelting division by the Platinum Process Control Department within the Anglo American Platinum processing division. Since Anglo American had already obtained licences to operate the Power BI software on an enterprise level, the infrastructure to develop reporting was already available and accessible without significant investment. Furthermore, all Anglo American employees would have access to the reporting tool.

Visualisation tools within Power BI

Table I: Power BI tools (Ferrari and Russo, 2016)

Tools	Description
Visuals	These are charts and infographics utilised by Power BI developers to represent data.
Dataset	A dataset is a collection of data utilised for reporting.
Dashboard	A dashboard is a single view containing different interactive visuals and displays the information on one screen to answer different questions or tell a story.
Report	A report is one or more pages of different visuals collated to provide information based on a singular dataset.
App	The app allows a mechanism to put the different pieces of dashboards, reports and datasets together to seamlessly work through the information presented.

The benefits and possible drawbacks for the system were described by Microsoft in its description of the product.

Advantages

- Power BI has the capability of connecting to multiple data sources; creating centralised reports with different data sources.
- Users are capable of asking questions about the dataset as part of the Power BI content pack.
- Larger amounts of data can be stored and compressed within Power BI compared to Microsoft Excel.
- There is increased security to the row-level that can be applied within Power BI.
- Power BI can be viewed from mobile devices as part of an application or via the web service.
- Data refreshing can be automatic and scheduled (min 0.25 hr frequency).
- Visualisations are interactive and can be used to drill down and consolidate data.
- Users can subscribe to reports via email subscriptions.
- Power BI can use machine learning on data and write back the results to data sources.

Drawbacks

- Power BI has a data limit of 8 GB.
- Training needs to be completed to understand the software and the complexities attached.
- Not all visualisations may be sufficient (however there is capability to code in R and Python to create customised visuals).
- Data modelling may be required in terms of complex relationship setups.
- Power BI exports currently only to Microsoft Powerpoint or as a PDF (not Microsoft Word.)

One of the key aspects of the automated updating of data is achieved through the use of a data gateway. The on-premises data gateway serves as a connector to ensure data transfer occurs speedily and securely between on-premises data and the Power BI cloud services.

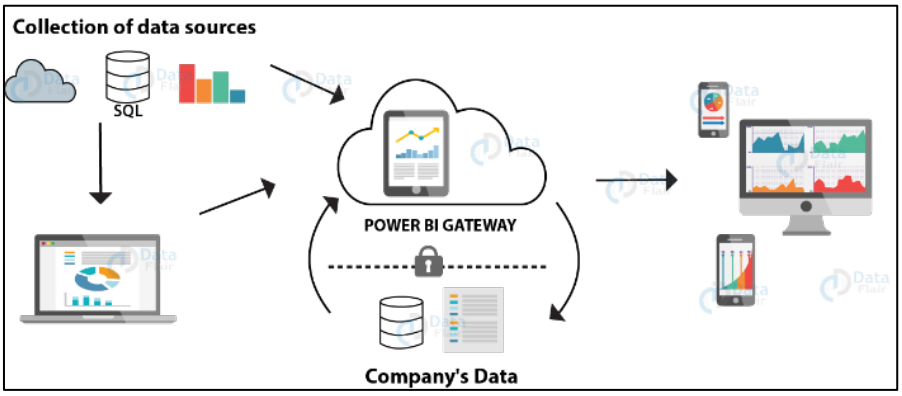

Figure 1. Power BI gateway process flow (DataFlair Web Services Pvt Ltd, 2023).

Industries Utilising Power BI

Multiple industries utilise the Power BI software for their organisational needs. These industries include retail, manufacturing, finance and insurance, education and the medical industries. The reports have had varying functions across the industries. In the case of H&M, it helped combat data loss, and developed insights into how the products were used by their customers. Other manufacturing industries were allowed to measure KPIs that measure the processing efficiencies and quality of products.

In the financial and insurance industries, the use of Power BI allowed the view of key financial metrics at any given time and this was further extended to balance sheet and profit-loss analyses. In other reporting, the data was used to indicate possible instances of fraud and duplication. By utilising artificial intelligence along with Power BI, forecasts of revenue and sales pipelines were made possible.

In the medical field, patient data could be monitored in real time and this information could be made immediately available to practitioners for problem-solving and emergency care. Data can also be easily shared with others to provide holistic care with various experts. In the education field, dashboards are used to provide information on student enrolment, administration, course information as well as progress monitoring (Solanki, 2023).

Method of Implementation
The report development process was initially ad hoc with various reports developed without a specific procedure. This was then executed to streamline the process. The overall process of development is described in Table II.

Table II. Planning process of development of reporting

Planning	Actions	Responsible person	Estimated time
KPI decisions	Strategy to be developed.	Report requester	3 hours
	KPIs to be defined.	Report requester	4 hours
	Frequency of each KPI to be established.	Report requester	1 hour
	Provide developer with data as per required frequency.	Report requester/ Department head	24 hours
	Visual decisions to be provided. with advice from developer.	Report requester	4 hours
	Develop required query.	Control engineer	1 hour per template
KPI development on Power BI	Query editing in Power BI.	Power BI developer	Standard – 2 hours
	Loading into Power BI and visuals/standards.	Power BI developer	2 hours per page
	Developing a contents and description page.	Power BI developer	2 hours
	Publishing to Power BI connection and setting up app, refreshes, gateways and notifications.	Power BI developer/ Service desk	2 hours
Data validation by developer	Check all KPIs match Check all visuals represent the KPIs correctly	Power BI developer	12 hours
Data validation and approval by site	Validate and approve	Relevant site personnel	1 week

The development of reporting goes through the following steps:
Step 1: Reporting structure to be confirmed.
Step 2: Data validation for each of the reports in the structure needs to be completed.
Step 3: Queries to be developed for each of these reports.
Step 4: Queries edited and visuals created.
Step 5: User acceptance testing.
Step 6: Build into production workspace and monitor performance.
Step 7: Ensure a level of standardisation, consistency and formats and report design.

Data Integrations
Currently all forms of reporting use source systems to report in terms of data transfer through extraction, load and transformation methodologies. Figure 2 describes the current methodology being utilised at the smelters based on the reports extracted from various data sources and intermediate data systems.

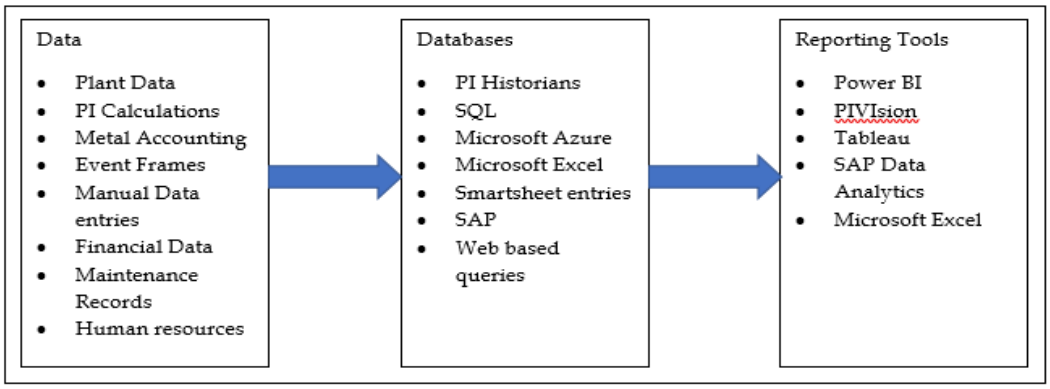

Figure 2. Reporting data flow.

There have been challenges based on the aggregation and collection of data due to differing systems presenting information and data in differing formats and data structures. These can then lead to inconsistent relationships and a significant rework of the data within the reporting tools to ensure consistency.

Training

A key focus point to improve operational efficiency and production is the upskilling of employees within a company. This further assists in retention of employees and can assist in worker performance. Digital training offers a way to continue learning and development past onboarding in an easy, time- and cost-efficient way, without the need to use all the resources necessary for dedicated in-person training. (Buchanan *et al.*, 2016)

The mission is to deliver skills and knowledge that increase the target audience's on-the-job productivity, thereby enhancing their contributions to the goals of the organisation. The training strategy includes identifying the necessary audience for the reporting and the desired skillset and competencies required of the users. For each of those requirements, available training needs to be identified and coordinated or provided at specific frequencies.

Different methods of training can create an opportunity to spread the knowledge to a wider variety of personnel slots thus increasing flexibility. These knowledge sharing sessions include in-person training, self-training opportunities and other online resources.

An assessment of the current talent pool, what is required for the future roles and the tools to do so, is required. Different roles within the organisation require different skill sets. Through the use of a training matrix (which needs to be consistently updated), gaps were identified within the teams on site and the organisation as a whole as described in Table III.

In order to identify the gaps, it is critical that a report identifying the skills of all the relevant people be availed to identify the digital learning health of the organisation and the requirements thereof. Some of the key learnings need to include understanding the boundaries and limitations of the data; understanding the data sources and how the system is maintained.

Table III. Training matrix

Personnel Group	Awareness	Source Systems Basic	Source Systems Advanced	Power BI Basic	Power BI Advanced	Data Analytics
Metallurgist	x	x	x	x	x	x
Site engineers	x	x		x		
Reliability engineers	x	x	x	x	x	x
Instrumentation	x	x		x		
Production Managers	x	x		x		
Technical managers	x	x		x		
Metal accounting	x	x		x		
Foremen	x	x		x		
Operators	x	x		x		
Operating model	x	x	x	x	x	x

Challenges faced in the implementation

The implementation of the reporting automation project can be used to improve employee culture although there are some challenges due to a variety of factors.

A dedicated organisational strategy is being developed across the business with operational teams to scrutinise and consolidate the manner in which reporting is delivered. Challenges arise when different operations are at different levels of maturity i.e,. a one-size-fits-all solution cannot be applied due to the diverging paths of different sites and their reporting. As a result, not all tools can be effective across all sites depending on where the individual sites are on the digitalisation journey.

Training awareness and development of the Power BI tool can result in apathy by the general personnel. It can be viewed as additional work which requires more training, resources and time from personnel whose core function does not include reporting but rather the use thereof. Specified resources need to be allocated to ensure that the migration to the new system happens seamlessly. It general, it is noted that this process of awareness and/or development training and practice takes between six months to a year.

Due to specialised systems existing within the operations, resources available externally to support the transition on a large scale are largely not available or are otherwise quite expensive. The resulting dedicated requirement to integrate systems into a centralised data lake is in progress to minimise this risk. However, source systems are still the main source of data. A multi-site and multi-department rollout of reporting is thus constrained due to the reduced skills availability. The development and training of people currently within the organisation may take a significant time, resulting in digitalisation targets not being met.

Key Results of Power BI Implementation

Report Metrics

Since the implementation of the Power BI reporting software with its various tools and capabilities, there has been an exponential increase in the number of reports, report usage and the number of users in the reporting structure across the processing division described in Figure 3.

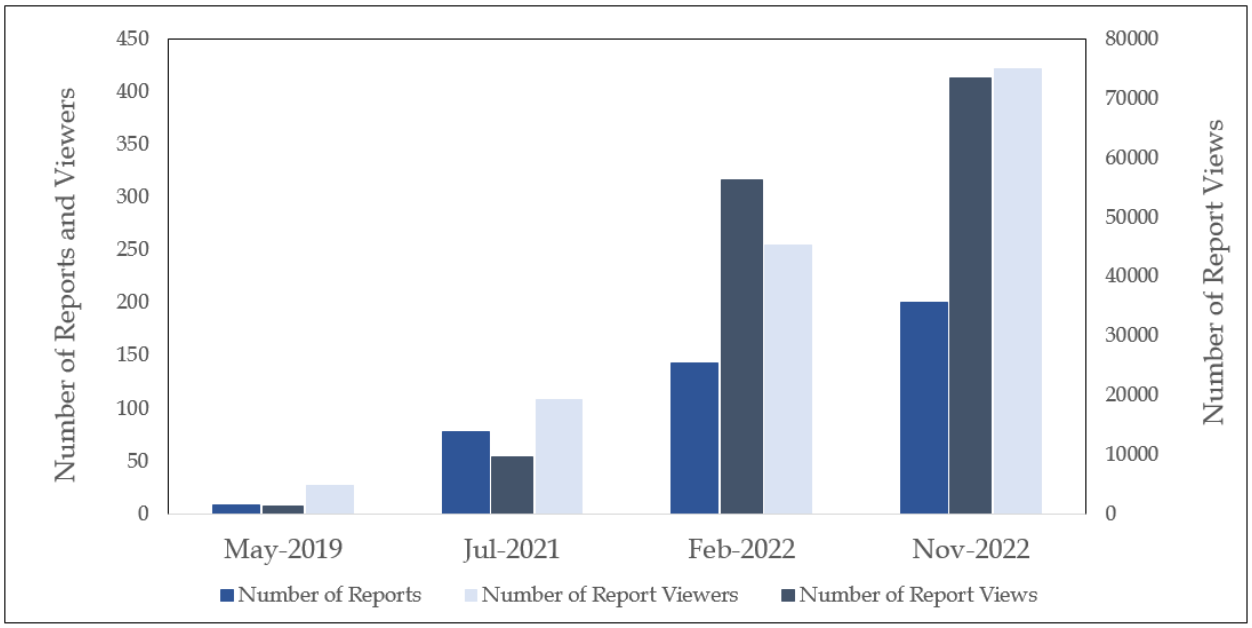

Figure 3. Power BI report usage metrics.

The number of reports over three years indicate an increase of 192. The increased availability of reporting allowed for increased engagement, showing an increase in the number of viewers by 395 (1462%) and the number of views by 72 219 (5722%). The slowdown in the number of reports developed indicates the influence on the maintenance of reporting along with the increased complexities of reporting. The number of resources allocated to purely development was not increased, resulting in the slowdown of reporting.

The introduction of subscriptions limits the number of views. If a user is subscribed to a report, a copy of the page subscribed on that report is emailed to the user and does not add to the count in the app usage. Furthermore, many reports may have been restructured, deleted or combined for consolidation and data flow purposes.

The adoption, creation and development of reporting has improved since the initial trial of utilising Power BI in 2019. An example is the increase in the number of reports in the period Feb 2022 to Nov 2022 by 41%, the number of viewers by 65% and the number of report views by 31%. The main report usages were led primarily by the platinum smelters and the process has begun more regularly in the Rustenburg Base Metal Refinery.

Other challenges included reporting refresh failures due to the fact that different data sources are being pulled at different times. This can create report user apathy when reports are not updated timeously and automatically based on digital resource constraints. This can be solved by the consolidation of the data into a singular SQL/Azure table to allow for consistency of data.

Case Studies: Implementation Examples

Mortimer Smelter

At Mortimer smelter, the Power BI journey began by sequentially going through the critical sections and undergoing a few steps to generate reports that could take information and inform decision making. The first of these steps was the KPI definition phase, whereby existing frameworks were used as a foundation to define KPIs that could empower the section metallurgist to be able to make decisions that would aid in the stability of the plant.

The first of these reports to be established was the Union Electrode Management Daily Report. For a six-in-line electrode furnace, electrode management forms the heart of the management of key furnace parameters. This report looked at the management of solid and liquid paste levels that would be measured on a shiftly basis, and manual data would be logged and imported into Power BI. Not only did this report trend the existing levels found, but it would also track the paste consumed per electrode and for the site as a whole. The report then used some of the Power BI built-in capabilities of predictive analytics to be able to predict the future paste levels, based on existing data of a fixed period. This is used by the section metallurgist in order to ensure these critical KPIs are managed and kept within specification.

Power BI reports then became the core of the monitoring routines at Mortimer smelter, with the Flash Dryer, Water Management, Furnace and Furnace Binding sections each having dedicated reports that translated data to information that could be used to make decisions. These reports are used in different management routines, such as shiftly meetings, daily production updates, daily technical reports and monthly reviews. They also form the basis for investigations and are used in conjunction with other monitoring systems to assess section performance versus targets set for that section.

For furnace rebuilds, dedicated reports with critical monitoring information were formulated. During a furnace rebuild, there is a heightened focus on monitoring to ensure that the integrity of the furnace is maintained throughout the process. Hence the importance of having a system that can combine different sources of datasets; connect to different databases and create information that forms the basis of decisions made throughout the process.

Power BI has empowered the right people to do the right work, and has improved the quality of the decision making taking place, given the ability to translate data to information.

Waterval Smelter

Metallurgical oversight/reporting of the Waterval Smelter Complex (WVS) has historically not been enabled through the use of a standardised system. It has instead been dependent on people. WVS is the largest of Anglo American Platinum's smelting complexes and the most complex in terms of the number of furnaces, associated auxiliary equipment and integration thereof. As a result, WVS has typically had the largest metallurgical team overseeing the different processes; amplifying the problem of people dependency on metallurgical oversight/reporting.

The challenge faced by the processing personnel that led to the implementation of Power BI was that processing personnel were not able to efficiently perform metallurgical oversight and reporting due to:

- Limited collation of data in one place (data sitting on desktops and data across various platforms).
- Significant preparation time needed to convert data into a usable form.
- Repetitive tasks with the same lengthy preparation time and
- Presentation of data that does not have a uniform template.

Since 2021, 25 Power BI reports covering the KPIs of the three plant sections at WVS have been developed and published in the smelter workspace. Each of the reports have been built with the same template and in consultation with the metallurgical team in order to achieve the required data and visualisation. In summary, this has achieved the following outcomes:

- More consistent and straightforward access to information (Online Power BI dashboard).
- Different datasets and information collated in a single structured workspace (Microsoft Excel, Historian data etc.)
- A system aligned with the operational processing team's needs.
- A tool to run effective management routines (accountability reviews and issue progress reviews).

Thus far, there has been a clear benefit in terms of time saved in report preparation and the presentation of uniform data by different site personal. An example of this is the three sectional month-end reports that are compiled by different metallurgists. Unlike the past, the reports now carry the same format; content is consistent between months and the reports are quicker to compile. A single month-end report

would take up to 12 hours to compile before Power BI. On the contrary, by using an already-built Power BI report and the 'export' function, this time has halved. The focus of compiling month-end reports has started to shift from collection and formatting of data to the analysis of data.

ACP

The Ausmelt Converter Plant (ACP) processes furnace matte from all the Anglo American Platinum smelting operations. Due to the locations of Mortimer, Polokwane and Unki smelters, the material is transported via tankers and offloaded at ACP with pneumatic conveying into dedicated silos. The available stock at ACP is dependent on the efficiency of the movement of the tankers between the sites; highlighting loading time at the smelter, loaded tanker travel time, offloading time at ACP and the empty tanker travel-time back to the smelter to load again. This is the total cycle time of the tankers, where the required target is dependent on the available tankers and their allocation per smelter.

Meetings are held with the transportation company and site representatives daily, monthly and quarterly o discuss performance and the foreseen and unforeseen challenges in meeting these targets, going forward. As the main stakeholder, ACP manages these meetings and is responsible for escalating any challenges that would contribute to not maintaining stock levels and material grade on site. This is dependent on the section metallurgist to compile the data in Microsoft Excel and ensure that accurate reports are sent out on a regular a basis. This is critical as the availability of stock affects the pipeline; not all stakeholders are aware of the challenges and/or are able to ensure they are resolved. This is especially critical as the information is compiled from various sources and people from all sites and levels require the visibility of this information to ensure the smelters achieve their targets and that the transportation company meets its contractional requirements.

All the critical performance data is compiled into a Power BI report that automatically refreshes on a daily basis. The visualisation tools Power BI provides in terms of filtering and date hierarchy drilling give users the functionality to evaluate data over long periods of time and better understand the performance constraints and their subsequent cause and effects on the process. In conclusion, the Power BI report provides the required visibility and ease of access to information.

The data pulled into this report is highly dependent on the weighbridge tags per site to remain constant. There have been instances where different material blends were processed and different weighbridge tags allocated. This needs to be updated in the totalised calculations. Fortunately, due to the robustness of the system, it allows for these changes and the addition of multiple side streams to assist with long term data analysis. Compiling long term data like this in Microsoft Excel is time consuming and is not without any data visualisation errors and/or sheet failures.

Polokwane Smelter

The Polokwane smelter was the first operation to utilise Power BI reporting for operational purposes in the smelting division. Daily and shiftly production information at the smelter was collated at the beginning of every shift by the relevant process overseer and/or control room operator at the beginning of every day shift. This process depended on the situation within the control room itself, and ultimately spanned a period of 30 to 45 minutes. It consisted of information regarding the key daily production metrics of the entire operation. The data collated by the team was then shared to management who critically analysed the information for performance purposes along with monitoring for data quality purposes.

Due to the manual nature of these tasks, mistakes and typing errors were often made and this necessitated discussions that should not have happened and further could have jeopardised the analysis of the said problem. Finger errors are common in a high stress environment such as a control room and can lead to mistakes in reporting to different levels.

Upon receipt of this information from the control room, metallurgists within the operation also critically analysed and developed trends to report on prior to the morning meeting. This required metallurgists to ready spreadsheets prior to a meeting along with commenting on situations in the space of an hour

with very little time to critically analyse the data necessary to make informed decisions based on the trending. The data was readily available within the historians and as a result, the daily report was sanctioned to be automated to live within the Power BI framework. This was tested and the same format was subsequently then rolled out to all smelters. The daily production report within Power BI would be refreshed every day at 06:30 and the subsequent report automatically emailed to all relevant parties.

This resulted in an improvement in the handling of reports from an average of 30 minutes a day to 5 minutes, resulting in an estimated reallocation of 180 man-hours a year to other tasks. Further additions to the report include the addition of key site KPIs onto control charts for easy identification of problems and situations where the KPIs are out of the control limits. An example of the reporting is displayed in Figure 4 which indicates an example of the visuals for a shutdown day.

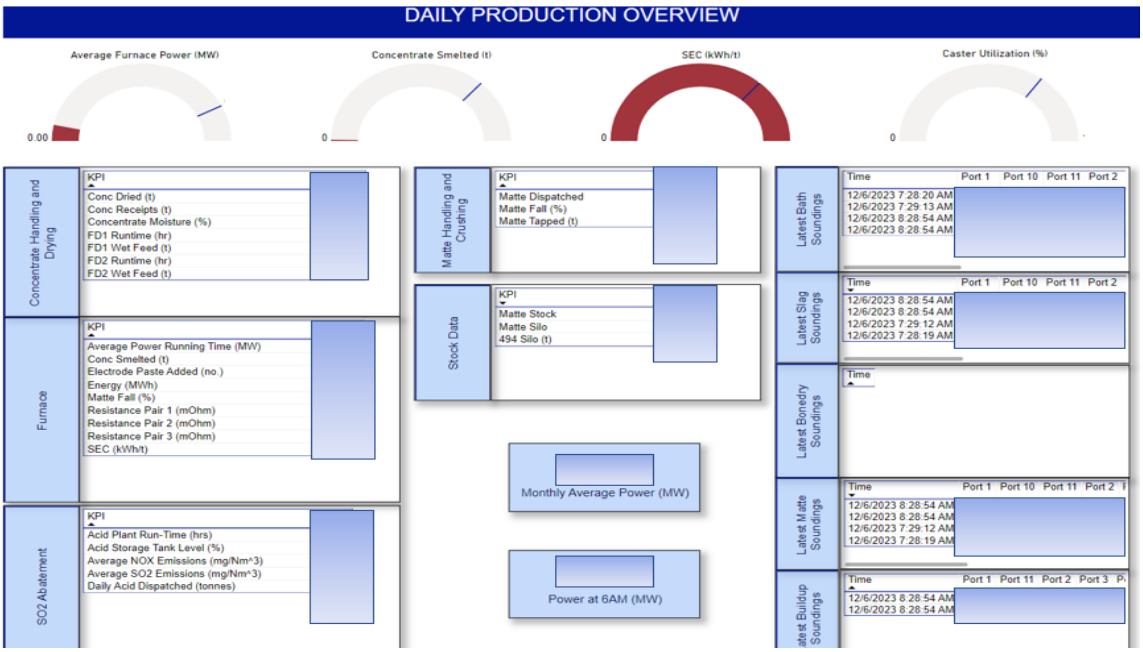

Figure 4. Polokwane daily report format.

Asset Reliability, Engineering and Maintenance

The engineering and reliability teams have utilised Power BI to be the catalyst for driving the culture of data-driven decision making. The concept of data being utilised in problem solving had previously been commonly utilised in metallurgical and production spaces where there were well defined performance targets with historical references. In the maintenance teams, the problem solving techniques were previously highly dependent on experience of the relevant personnel and physical interaction with the problem was required. Additionally, the ability to monitor and trend reporting of historical performance was often underrepresented in the reporting framework.

The use of Smartsheet and other manual data entry tools has allowed Power BI to become a tool which effectively changed the culture of problem solving and led to new and innovative solutions improving the response to breakdowns and allowing for earlier predictions in the possible failures of equipment. In addition, Power BI has been an effective tool in the human resource monitoring space to assist in the tracking of training matrices of personnel which ensured the reduction of administrative work for team leaders to allow them to focus on core maintenance tasks.

Conclusions and future work

The implementation of Power BI has increased the breadth of data reporting significantly within the operational space of the smelters. There has been a significant increase in the usage of the reports from all levels of the organisation, with some reports being viewed at a shift level and further reviewed by

board members while being in the exact same format. Due to further upgrades and developments in Power BI, the reports are constantly under revision and continuously improving to suit the needs of multiple audiences. As evidenced by the different case studies, the reporting within Power BI framework has been utilised for a variety of functions.

However, some drawbacks faced stem from the cultural shift required for reporting on Power BI. It was anticipated that, with the advent of Power BI, the use of Microsoft Excel reporting would diminish, but this has yet to happen. There are a number of hurdles expected to be overcome to ensure the full implementation of Power BI. These include assigning dedicated resources to train the implementation and use of the system; improving awareness and people capabilities to use the tool within the organisation. During this journey, it was noted that more education on the use of data is required i.e., what data is required for the purpose of either reporting or problem solving? The resultant data must be specified and standardised accordingly and thus the procedure to collate the data was specified and developed to assist.

Looking ahead, frequent refresh fails, due to the size of the data and number of reports trying to refresh early in the morning are a challenge. To date, report development has been handled by a small number of personnel on site. Upskilling of the remainder of the teams' Power BI skills will be advantageous in cementing the use and maintenance of the existing reports and the development of new reports when the need arises. For the remainder of the company, the culture shift to accept Power BI as a trusted reporting tool needs to be further embedded.

In addition to maintenance, resource and structural issues faced with Power BI, additional work is required to overhaul the data source infrastructure to ensure a more streamlined process. The data and information accordingly must align with the standards and specifications, and be applied indiscriminately across all data types and sources. Anglo American has begun the implementation of cloud-based services for data handling and validation. Development, testing and production workspaces for the reporting platform are also being explored further to provide a more secure report deployment via the Power BI deployment pipeline. This pipeline will effectively split the reports into different workspaces depending on the stage of development of the reports.

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Rivashan is an Analysis Specialist having worked in the platinum smelting production space as a metallurgist and in the process control space as a control engineer. He now is in the Strategy and Business development department of the company. He is passionate about technology and the implementation thereof across the business to improve efficiency and enhance automation.