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Improving Consistency of Delivery at Mt Rawdon Operation

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ABSTRACT

This paper outlines the journey of cultural maturation and management system development at the Mt Rawdon (MRO) gold mine from its acquisition by Evolution Mining Limited (Evolution) in late 2011 to 2016.

Evolution embarked upon a series of projects which aimed to improve the operational consistency and implementation of change on site, while leveraging off the existing strengths of the operation. This document describes the gaps that were identified, the processes used to close them, and the resulting cultural change and production outcomes, with a specific focus on how to optimise the culture at any mining operation.

MRO had a history of four owners in less than three years when it became a key asset of Evolution. The Site Leadership Team (SLT) decided to influence the culture at MRO by reviewing and upgrading the existing management processes.

The first priority was to improve transparency and collaboration at the SLT level, followed by improving competency in project management. The next phase was to strengthen the internal communication using a deliberately designed network of meetings, communication screens and other initiatives. Once there was some traction, the focus moved toward increasing production volume and decreasing cost per unit by improving short term planning and execution capability. Together with other initiatives, this resulted in improved collaboration between all functions which in turn netted over 37% mining production uplift.

Following solid success, a process of prioritisation and alignment management was implemented. This supported the 'mine to mill one operation' ideal and allowed the SLT to decide month-by-month what actions were to be prioritised. These priorities incorporated production realities and longer term imperatives of the Balanced Business Plan.

Much of this work was completed during a period of declining gold prices and a relentlessly strong Australian dollar, making it difficult to justify spending money on improvement projects. This work proved critical for the operation's long term survival.

BACKGROUND

The Mt Rawdon orebody is a massive, volcanoclastic hosted, low grade gold deposit with a current Ore Reserve of 864,000 ounces at a grade of 0.8g/t gold. The mine commenced operation in 2001 and has been in continual operation since. Over this period the mine has had four owners: Equigold; Lihir; Newcrest; and Evolution (November 2011 acquisition).

The treatment plant processes approximately 3.5 million tonnes of ore per annum, producing around 100 000 ounces of gold per year. The ownership structure and the straight forward nature of the early mining activities (low strip ratio, bulk mining and contract mining fleet) established a certain site culture. The processing plant management and workforce were very focused on process control and reducing variability in the plant's operating parameters.

With an increasing Australian gold price and changes in ownership, the mine grew from its original planned eight year mine life to encompass a series of cutbacks that will currently see processing continue until 2024. The commitment to these cutbacks required a higher level of material movement and corresponding scheduling detail. Whilst the depth and wall angles of the designed pit dictated the need for more technical efficiency and involvement.



Figure 1: Mt Rawdon Mine Open Pit – January 2016

INTRODUCTION: MOTIVATION FOR THESE PROJECTS

Upon Evolution's acquisition of MRO, the need to review the site's management and technical support team organisational structure became a clear priority. Evolution understood the importance of having the right people in place, ensuring that everyone was working toward the same outcomes, and that they were held accountable for delivering on their commitments. It was also essential that all processes worked whether key staff were on site or not. It was this desire to build consistency in the outcomes that initiated the journey MRO has been on.

The first step was a diagnostic review of the operation and its management systems. The questions asked included:

- How did the team interact?
- How well did they plan?
- How well did they communicate that plan?
- How consistently was it delivered?
- Did they review the outcomes
- Did they use the knowledge gained from this review to make changes to improve?

The important concept behind the overall aim when embarking on this journey was not about the tools used (the system, software and hardware) but the integrated management systems, business processes and overall framework.

PHASE 1 - KICKING OFF THE BASICS (MAKING THINGS HAPPEN)

Objective

Having finalised the review of MRO's systems, a snapshot of the site's positioning was produced. This included an overview of what was done well and areas to improve. The recommended actions were extensive and there was no budget allocated to this work. The commitment was therefore to start small and focus on some key improvements around how the site leadership team met and tracked actions, how the mining department could communicate their key priorities and deliverables more effectively; and how the site could deliver better on its projects.

What We Did

Overall Approach and Overarching Management Model

Once the decision was made in principle to proceed with these improvement projects, a scope was developed. Firstly, focussed on the communication points and starting with the SLT, the well-established Plan-Do-Check-Act (PDCA) cycle was used as the overarching process of the Operations Management System (OMS).

Weekly SLT Operations Meeting Upgrade

The first priority was to improve transparency and collaboration at the SLT level. The legacy weekly SLT meeting relied on an agenda, meeting minutes and actions in an MS Word file that was to be emailed to all SLT team members in a circular fashion. Individuals were expected to update the file and forward it to the next team member on the list. This process was ineffective and abandoned fairly quickly. The emailed Word file was replaced with a cloud-hosted app called Asana. The advantage of Asana is that it is centrally and universally accessible to all team members all of the time. Edits made by individuals are immediately visible by all collaborators.

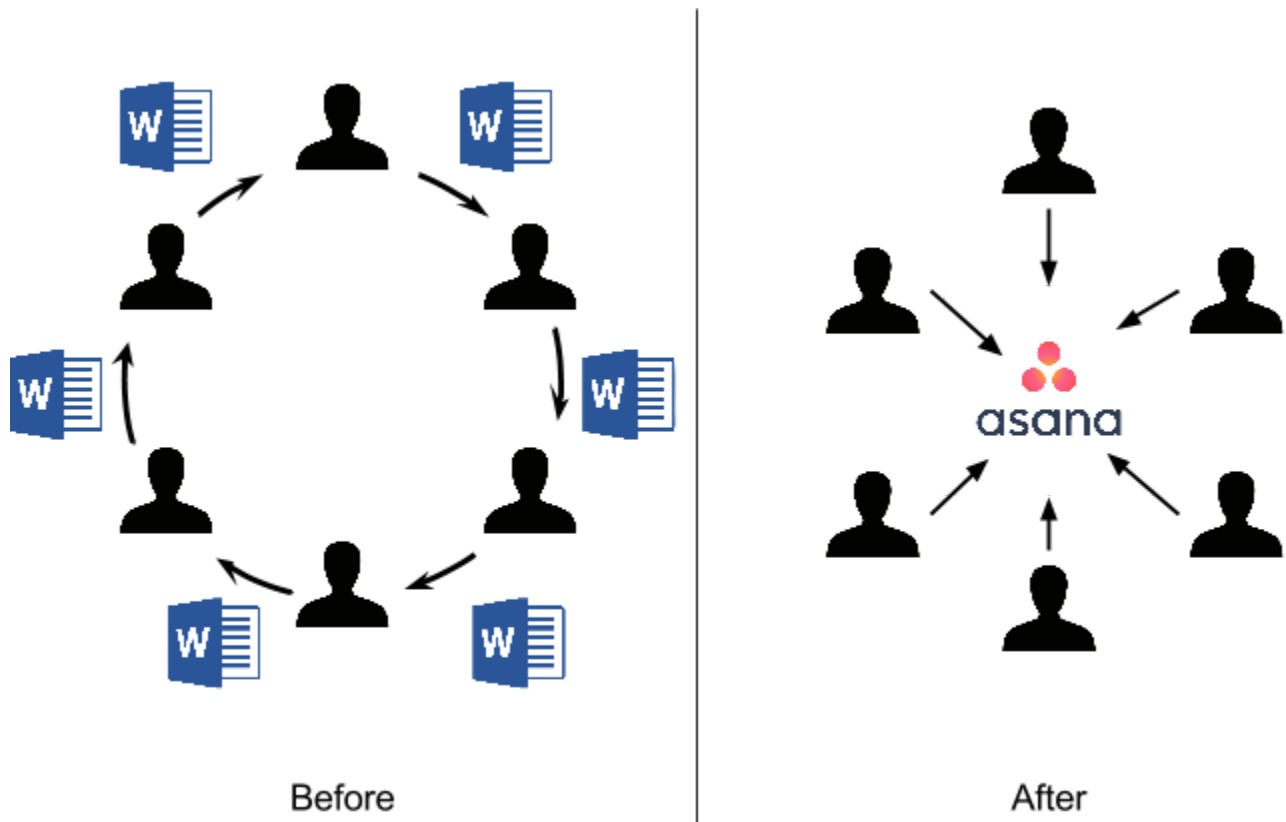


Figure 2: Weekly Meeting Process Change

The weekly meeting agenda was restructured to focus on the key actions and the areas needing attention. If it was on-time and understood there was no need to discuss in detail. All SLT members were required to update their section in Asana prior to the meeting and preferably as they gained updated information. Everyone could now see what had been agreed to any time and day of the week. Asana was the central repository for all of the KPIs, variances, issues, risks and actions required to address them.

The behaviour in the SLT changed from an initial negativity around the number of e-mails and the overall necessity of change, to an acceptance that this may have value, and finally to a commitment to being upfront,

setting realistic time frames and delivering on commitments.

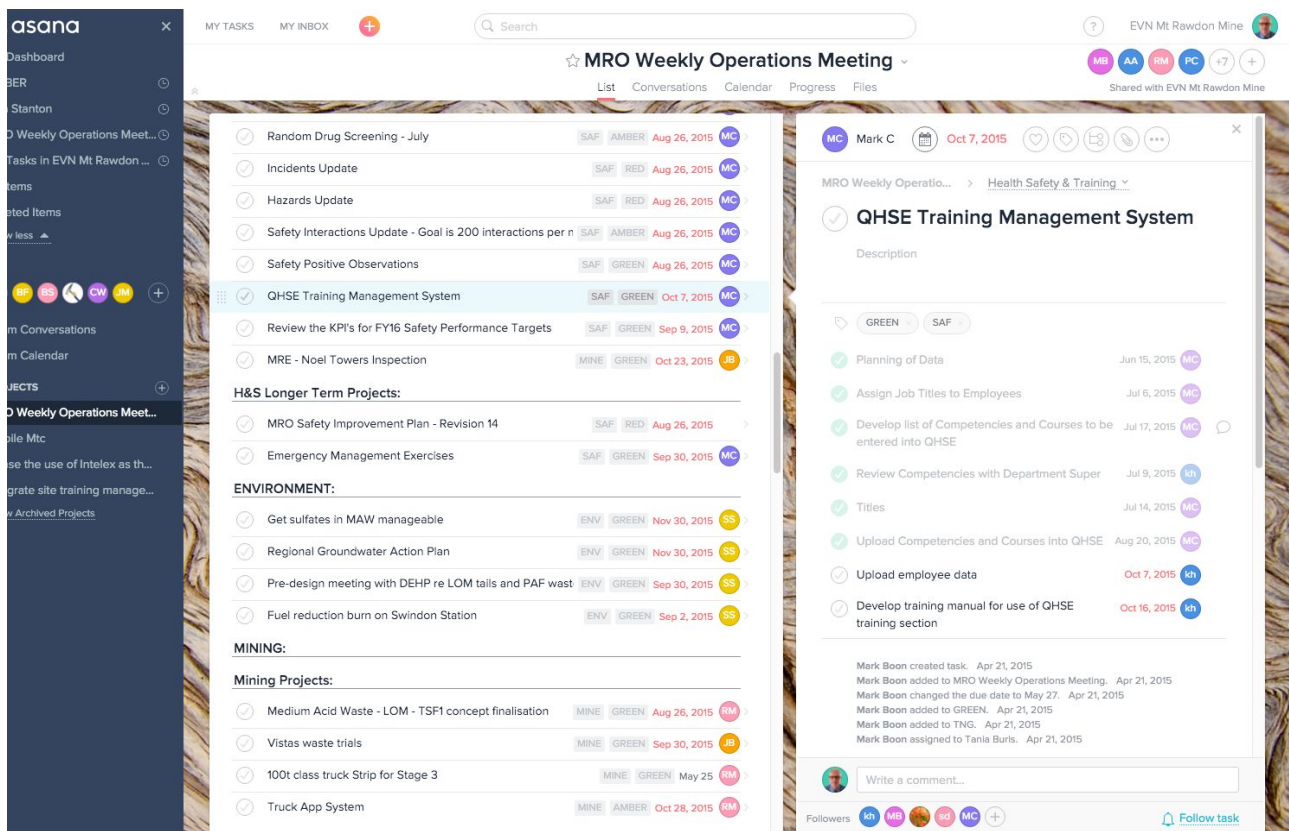


Figure 3: Screenshot of MRO Weekly SLT Meetings agenda and communications after Trello implementation

Development of Monthly Focus Meetings

In order to encourage more detailed discussions around safety, environment, people & culture, production forecasts and costs a series of weekly Focus Meetings were established as follows:

- Week one: Production forecast meeting - review of the previous month's performance and discussion of variance to forecast, and outline of the mining, processing and maintenance schedules (based on a weekly target).
- Week two: Review of operating costs and discussion of variance to forecast, and status of capital projects.
- Week three: Focus on safety, environment and people; what projects and initiatives were in progress and their status and what programs were to be initiated in the near future.

With the development of other business systems, these weekly focus meetings were substantially modified to become a single, monthly meeting, nominally in the second week of each month, with involvement from supervisor and technical staff as well as the management staff. This meeting provides a broader focus to the wider leadership group on what has happened and what is required going forward. It also exposes the group to

cost information and discussions on variations from plan. Each month of the quarter has a specific focus as illustrated in Figure 4.



Figure 4: Monthly Focus Meetings

0815 Daily Production Meeting Upgrade

In line with the overarching PDCA model, attention was turned to the daily production meeting which lacked the degree of transparency required for clarity and decision making. KPIs were not up to date and it was difficult to rapidly get a clear understanding of what progress had been made on site over the last 24 hours.

Again, a web-based solution was chosen to allow collaboration with all the contractors, who did not have access Evolution's network. Once an agenda for the meeting was developed we decided what data and trends were critical. This development provided transparency and improved the level of accountability.

Project Management Framework

With the short term management aspects improving, performance improvements were needed on the quality and timeliness of our longer term deliverables. The annual budget was never spent by the end of the year. This is a common symptom of (mostly capital) projects lagging. Project Management Body of Knowledge (PMBOK) based training was introduced, facilitated by external training providers. What was missing was a framework reflecting these PMBOK project management processes, tools and forms to enable this discipline properly. To meet this requirement a reasonably sophisticated project management framework (PMF) was developed.

This later turned out to be a bridge too far, too soon. Of the dozens of initiatives introduced, this is only one of two that failed to properly embed in the culture.

Site-Wide Communication (rolling TV displays)

As part of improving the site-wide communication, digital display screens where installed in areas such as crib rooms and the main office reception displaying information such as:

- time and type of the next blast in the pit

- safety statistics
- production data
- safety awards

As the site's network capability improves the number of screens will be increased to ensure a consistent message is delivered and is available to all site personnel.

A standard template of slides was established, currently using the production charts produced in a spreadsheet, which is updated from the a group production data template. Work is in progress at Evolution to move toward a group-wide data collection and visualisation tool.

PHASE 2 - WEEKLY PLANNING AND SCHEDULING

Objective

A second phase encompassing a more detailed review of the planning processes was envisaged but as phase one drew to a conclusion, the gold price took a dramatic tumble. MRO, like many other gold mines, was required to reduce spending. Although the processes that were being developing were aimed at improving efficiency and cost effectiveness, it was difficult to justify spending money on external consultants whilst reducing production and labour in other key areas.

To get to the next rung, people needed to embrace business improvement and drive it from one or two levels below the General Manager. This came about as the site leadership team undertook their second business planning cycle as part of the new ownership by Evolution. This process identified that site needed to establish an integrated planning system which would cascade from the long to the short term plans across all the facets of the operation. This required a change in mindset and the establishment of a discipline in the way people approach their work. First Principles Consulting had already provided some concepts around this and their people had established a degree of trust across the site. This made them the obvious choice to assist the operation.

This work coincided with a move from a load and haul contractor to an owner-miner operation. Although new skills were required, there was now a direct line to the front line supervisor. The aim was to schedule outcomes the whole mine site required rather than just those of the contractor.

Mapped processes and interactions

In order to develop a better process the current reality first needed to be understood, and alignment sought from everyone on its gaps to best practice. Over a period of a few weeks the value chain (VC) was mapped from Resource Definition drilling through to beneficiation. Interesting discussions ensued revealing that alignment on how the site currently operated was low, and how it should operate in the future was even less so. In that way, the mapping process as well as the final process map served a number of purposes:

- Provided common ground for discussion

- Allowed the teams to spot the gaps
- Provided visibility of possible solutions

Figure 6 is provided to show the complexity and number of steps identified from this mapping process.

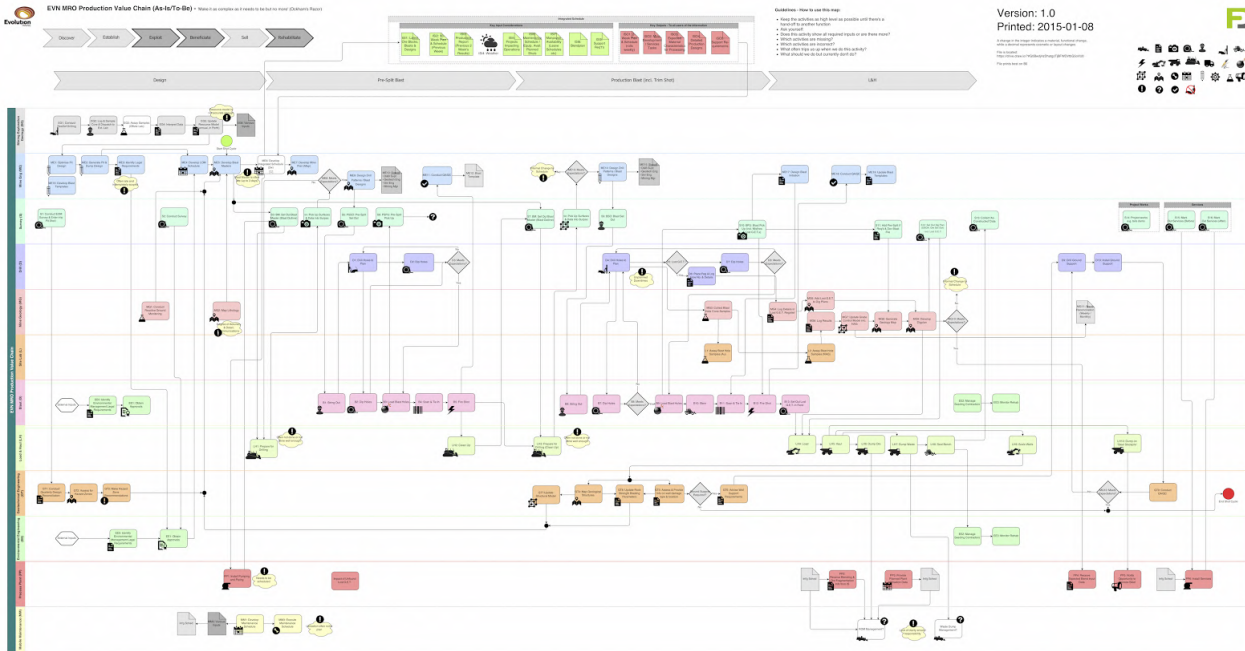


Figure 5: End-to-End Value Chain process map

Introduced team to concept of the Theory of Constraints (ToC, ‘Bottlenecks’)

Understanding the key constraints on a mine site is critical in moving toward a more stable production process and output. In a typical open pit mine the bottleneck has a tendency to be dynamic and shift over time. Recognising when this happens and achieving team alignment is a giant step in the right direction.

Introductory training sessions which focussed on the Theory of Constraints were conducted at MRO. People started to see and talk about ‘bottlenecks’ in the system. For example, the team identified that production drilling was a bottleneck, holding up the mine production. It was then a matter of prioritising and being clear that actions toward developing the next blast pattern location were to take precedence over other mining activities. Quickly the supervisors found that by doing this they had plenty of broken stocks and their production numbers exceeded the targeted rates. This was a good shift as production supervisors now had accountability for broken stocks following the move to owner-miner.

Introduced team to concept of Kanban (visual process management)

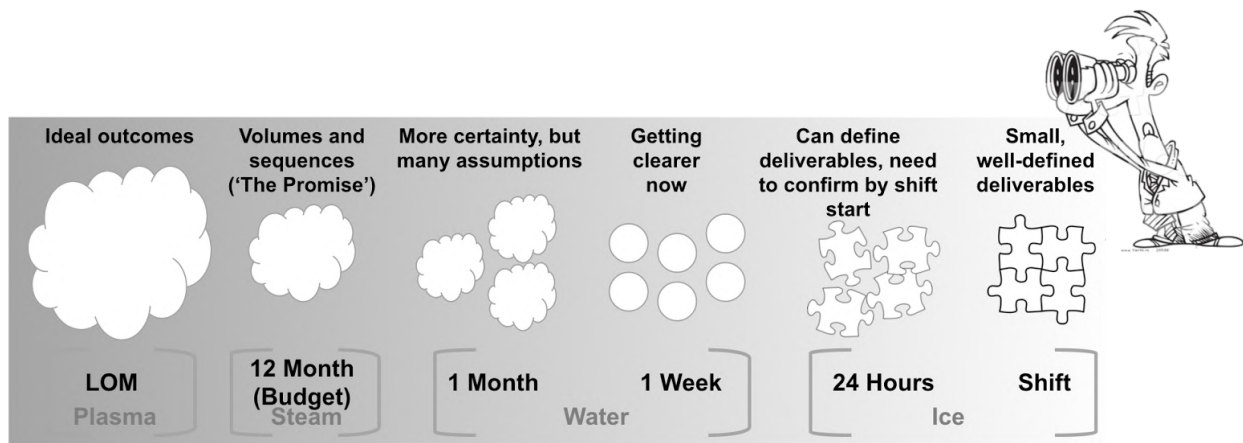


Figure 6: Rolling wave scheduling approach

A visual, real-time tool was desired to translate all the tasks from a broader monthly plan into a more detailed weekly and ultimately the shift plan. A cloud based software called Trello was shown as a potential tool. In preparation of rolling out Trello we conducted some basic training in the use of Kanban boards. The concept is very intuitive, as it involves a board similar to a whiteboard, lists (or columns) and individual cards. In its simplest form there are three lists: To Do, Doing and Done. Imagine a PostIt Note that may represent anything but usually represents a task or a deliverable. The team places this card in the first list and as the work progresses the card travels from left to right. Where it gets interesting is when this concept is converted to a digital representation, where these 'virtual cards' can have attachments such as pictures or anything else imaginable. Furthermore, a card might represent a task such as 'Dig 60_406'; now we might see instructions and comments from the process plant team as to how and where to stack the ore.

All of the above allows for true SMART (specific, measurable, achievable, resourced, time bound) task assignment, or similarly CPQQRT (context, purpose, quality, quantity, resources, time).

60-406
VISTIS

Dig 60_406 in list **Night Shift**

Members: CW MW MM 2IC PW +

Labels: L&H +

[Edit the description...](#)

Attachments

final_mu_60_406.png
Added yesterday at 7:55 AM
[Download](#) [Remove Cover](#) [Delete](#)

[Add an attachment...](#)

Add Comment

Write a comment...

[Save Comment](#)

Actions

- Move
- Copy
- Subscribe
- Archive

[Share and more...](#)

Activity

DM Daniel Morton
S/G to be stacked on the haul rd side of the ROM in three fingers.
2 hours ago - [Reply](#) - [Delete](#)

MM Meeting Mining moved this card from Proposed Next 24 Hours to Night Shift
5 hours ago

Figure 7: Example of Trello card representing a production deliverable

This software can be used on computers and as an app on smart devices (e.g. iOS devices such as iPhones, iPads as well as Android units). As a separate initiative with the change to owner mining in the load and haul MRO had taken on board the Truck App system developed at Evolution Mining's Edna May Operation. This

meant that all the trucks were fitted with iPads and data was entered into these and uploaded to the sites server as the shift progressed. To do this the mining area WiFi coverage needed to be increased. All the production supervisors were also provided with iPads and could monitor the production data throughout the shift, it therefore became a simple process to add the Trello app to their iPads. Now the supervisors could get updated information on dig plans, drill plans and other shift information. They could also change status on the cards representing their tasks by moving them either into a 'Completed' list for final checks or, if still in progress at the end of their shift, transfer the card with their updates into the work list for the on incoming shift.

Introduced an Integrated Daily Scheduling Meeting (13:00) to cover full 24 hour cycle

What did all of this preparation lead up to? Why so much effort mapping processes, debating what they should be, finding suitable ICT platforms to enable them, training personnel in the Theory of Constraints and Kanban? What had been missing at MRO was a solid 24 hour plan and a means of collaboratively developing one. All of the preceding work led to a new daily meeting with the sole objective of committing to the key activities and deliverables for the period from 18:00 today to 18:00 tomorrow. The team was ready to start holding these meetings daily.

A cross-functional team with representation from all production and production support disciplines (drilling to milling) then consistently met and agreed on a plan for the next 24 hours. The team documented that plan in the aforementioned virtual 'cards' in Trello, each one representing a deliverable from a specific production process, on a Kanban board on a projector screen. At the end of every meeting the team disbanded, knowing exactly what was expected of each of them, and in turn, their specialist teams. They also knew that in 24 hours they were to meet again and report progress on their assignments - had they been done or not? If not, why not? What can we learn from this? The power of peer pressure can be very strong indeed.

Introduced Weekly Scheduling Meeting (Tuesday) to cover next 7 days

Part of this new process was to introduce the weekly plan to the team on shift change day, Tuesday. The mining engineers presented 3D images of 'where they were going to go', followed by a walk-through of the new 'cards' in the 'This Week' list. These cards had been uploaded in bulk at the click of a button after the weekly schedule had been completed in MineSched and Excel, so did not represent any additional work to the engineers. But this simple act 'democratised' the plan by making it accessible to all players in the team.

Introduced explicit 'Processes and Rules' and refined them as a team

This is not an off-the-shelf software package but a bespoke, customised business process for a specific team and site. It is important that the team agreed on the specific sequence in the process as well as the rules of how certain things were done, what was allowed and what wasn't. It was a reiterative loop of the project team tabling process and rules for discussion, the site team reviewing them and suggesting adjustments. Again, never underestimate the power of a competent cross-functional team: in many cases the team proposed revisions to

the process and rules that resulted in overall simplification and improved robustness. Ultimately these rules were documented. Unfortunately they are not kept up to date as well as they should.

Upgraded the Daily Production Meeting:

In line with the developments of daily planning and scheduling some tweaks in the Daily Production Meeting were also made. In particular, as the final part of the meeting, the team now reviews the current production schedule as it stands in Trello. In an ideal case this is simply a confirmation of who is currently working on what in which area. The quality of yesterday's production schedule can be gauged by how much 'adjusting' it takes in the morning production review meeting.

Daily Production Report Upgrade

The project team made some fairly radical changes to the report that the site team reviewed in the Daily Production Meeting. Apart from the leading and lagging safety KPIs, it now focussed on making the outcomes visual around whether the targets were achieved or not. The report looked at key indicators we wanted to track including bank cubic metres (BCM) mined, BCM drilled, ounces produced, average plant throughput (tonnes per hour). These are presented on one page as a traffic light system showing whether the targets were achieved or not with an area for comments to explain any variation.

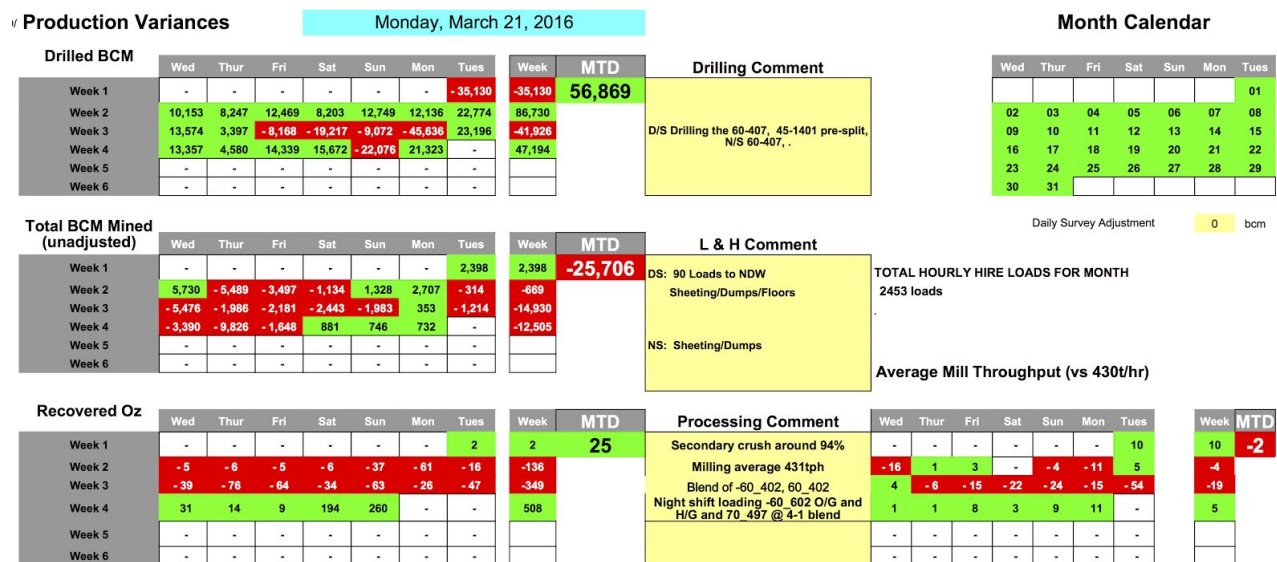


Figure 8: Screenshot of a daily review meeting dashboard

Confirm tasks for the day instead of planning them

One way the daily planning effort manifested itself in the Daily Production Meeting was that there wasn't a mad scramble to plan the rest of the day's shift that had already been underway for a couple of hours. That task had been completed the day before. Instead of 'planning' the team now simply confirmed activities in progress and made minor adjustments to others (remember, the 24 hour plan can quickly be brought up on the screen and

team members keep it up to date in real-time). This reduced distractions and streamlined this important daily meeting.

Introduced an Action Log

At this point we once again attempted to introduce formal action management at MRO. The kinds of actions sought are mostly short term responses to variances, events, issues, risks etc. We figured the team was now ready for a bespoke Concern>Containment>Countermeasure approach used so effectively in Lean deployments. This proved to be too much too soon.

PHASE 3 - THE NEXT LEVEL

Objective

The work done had established some great building blocks around performance and drive but it had focussed on the shorter term, the daily activities. The next steps were to get more of the longer term planning stages better interlinked into this new system and also to better integrate the former external contractor teams into a single Evolution team. Breaking down the barriers and silos and also understanding why they were there was a key in committing to taking the process to a third phase.

Productivity Diagnostics in Mobile Maintenance & Stores

During this phase the focus moved to the Mobile Maintenance team, as the site's future plans required more load and haul capacity. As Stores works hand-in-hand with Maintenance, it made sense to include their performance to more detailed scrutiny at the same time. The diagnostic revealed that in both functions there were process steps missing, as well as some key shortcomings in the configuration of the ERP. This combination leads to some specific lack of behavioural activities due to no fault of the team members.

MBTI Personality Workshops

Team members were asked to take the brief online Myers-Briggs (MBTI) personality assessment. The results illustrated why some people had more difficulties getting on with each other and why others got on so effortlessly. The reason was that the latter had similar personality preferences, while the former group were further apart in theirs. The further apart, the more challenging their relationship tended to be. And yet, we also know that diversity in teams can bring huge gains.

The insight that this provided was helpful in overcoming some of these differences. People were encouraged to see things from other perspectives.

KPI Development & Value Driver Tree - Constraints & Volumes

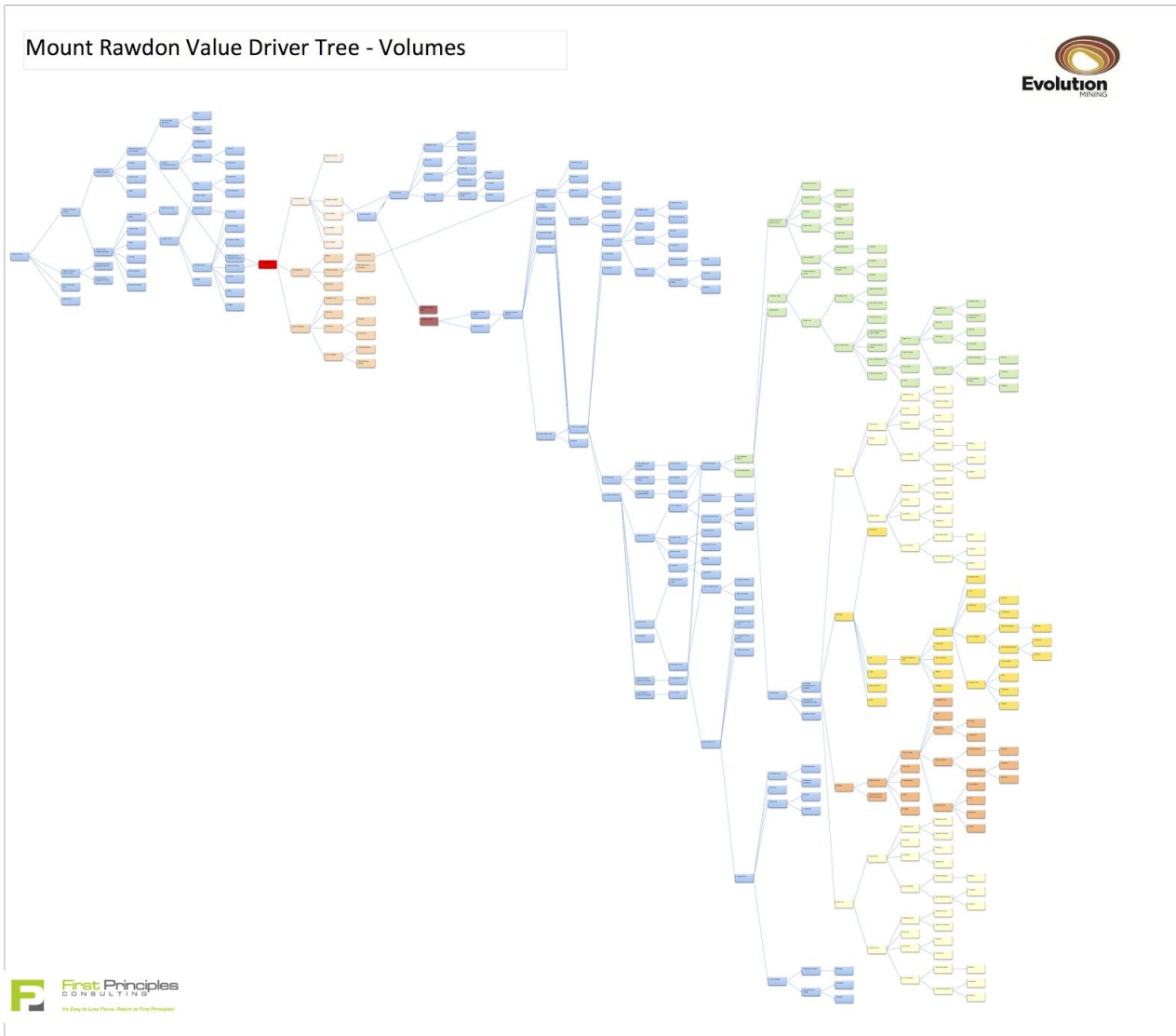


Figure 9: End-to-End Value Driver Tree (VDT) including all production and functions

A review of the end to end process was conducted identifying all value drivers associated with volume and quality and a Value Driver Tree (VDT) was developed. This VDT clearly displayed the drivers for volume and for quality of production at all stages of the end-to-end process. This VDT improved visibility of the process and the impact of upstream performance throughout the entire process. This VDT was developed as an input into the development of KPIs and for analysis of process constraints. Figure 11 is provided as demonstration of the extent of the process and not to display the actual detail of each branch on the tree.

In parallel, an analysis of process constraints was conducted to identify the limiting factors for process throughput. The VDT then guided development of KPIs primarily measuring the performance of constrained

processes, and metrics associated with those KPIs to understand the behaviour of the drivers identified as being significant for the constrained processes.

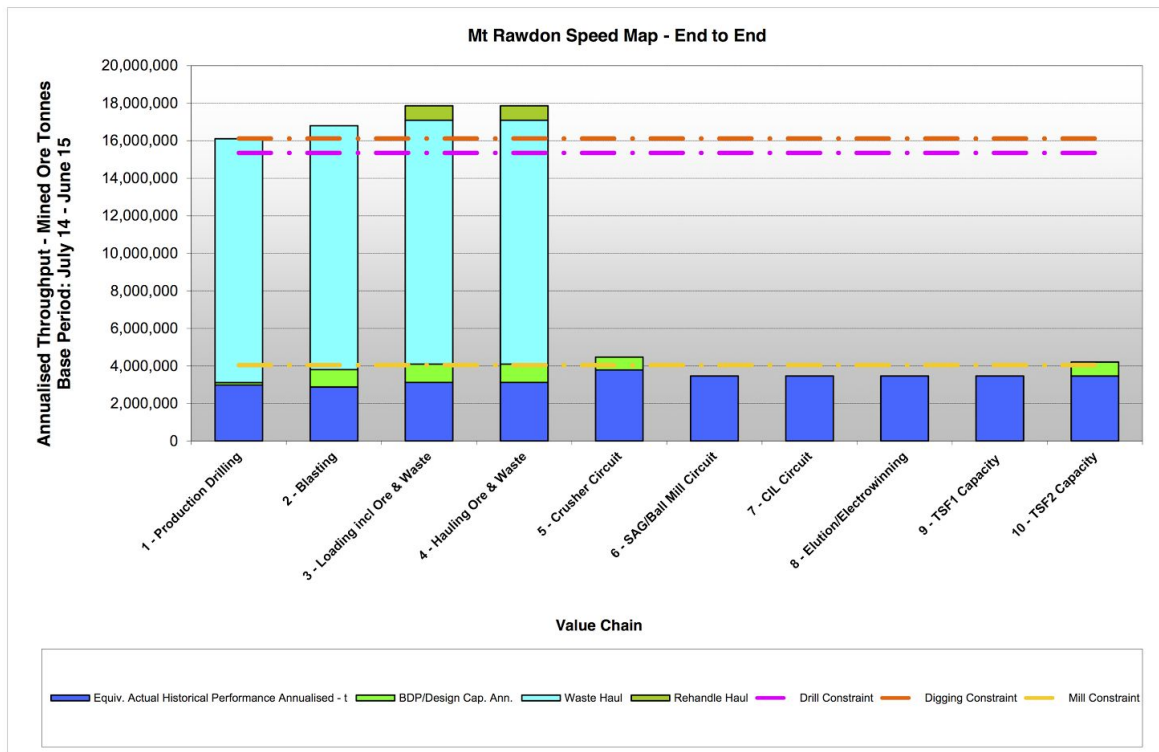


Figure 10: MRO Value Chain or 'Speed Map'

From this analysis it was also identified that a single stage of the process was the limiting factor for the entire site and that significant relaxation of this constraint was required before it would shift. For this reason it was agreed that KPI measurement and review for this constraint was essential for maximising site production. KPIs were identified using the VDT along with metrics for understanding the drivers of those KPIs.

KPIs were also identified on a lesser scale for monitoring performance of the other, non-constrained stages of the process. These additional KPIs were chosen to ensure that whilst emphasis would be placed on the constraint, other stages remained under control and to understand if other temporary constraints were developing within the entire process.

Monthly Prioritisation Process

A large component of this phase was focussed on taking the gains made within the SLT to the next level. The framework chosen for this effort was called STARR, which stands for strategy, tactics, actions, review and results. This process facilitates cascading the long term goals into shorter term actions. At its core is a monthly

prioritisation cycle that acts like an engine room for the SLT to get more things done. A critical part of this process is that on a monthly basis each functional team (mining, processing, geology, etc) meets with the GM one-on-one to align on what that team's priorities will be for the coming month, after looking back at the closing month's attainments against plan. Importantly, these priorities may stem from the Balanced Business Plan, emerging production events, HR issues, corporate requests, cyclic activities such as budgeting and so on. Essentially, it is a method to balance short-term urgent issues with long-term important ones.

This changed the dynamics of the weekly SLT meeting. As the GM now had an opportunity to routinely 'deep dive' into departmental issues at least on a monthly basis, which proved insightful in its own right, there was less need to try and do so in a larger group. As a result the meeting became a touch-base for progress towards the promised monthly priorities as well as an opportunity for cross-functional integration.

Ultimately, a transition was made from Asana to Trello, where all of these agreed priority deliverables are represented in the SLT Kanban board.



Figure 11: Screenshot of MRO SLT weekly review meeting Trello board

Departmental Trello Boards

These priority tasks are also reflected in departmental Kanban boards, which are interconnected. Each department meets internally prior to meeting with the GM. The team first aligns internally regarding what they think is important to get actioned in the coming month and what can be de-prioritised. The more effort the team puts into this task the less re-prioritising the GM needs to do with them.

PHASE 4 - EMBEDDING / RAMPING UP THE MOMENTUM

Objective

As Phase Three concluded, a workshop was conducted where the site leadership team members provided feedback on what went well and what could have worked better. First Principles Consulting also presented their views on what they thought were the next logical steps. After this presentation the SLT was asked what of the various proposed actions they thought should be progressed. All the SLT members saw value in continuing into a new phase, with clear areas they saw as priorities over other actions proposed.

Improve Interdepartmental Integration

This project segment focussed on making the Mine-to-Mill (M2M) meeting more effective and transitioning it from a project phase to a regular operations meeting. This meeting hadn't existed prior to a very specific blast fragmentation optimisation project being launched. The second focus of this segment was on further integrating Mobile Maintenance with the mining operation. At the time of writing, both of these initiatives are in early stages of maturity.

Optimise Mine Technical Group Performance

One of the remaining challenges was to ensure that the weekly production plan and schedule would be produced without fail. It was observed that during the weeks that the mine technical services department failed to produce this plan, production lagged. It also made the daily planning meetings far less effective and produced a continual 'hand-to-mouth' starvation situation for all teams. To overcome this, the project team analysed where the operations team's time was being consumed and how teams on one swing of the roster conducted their daily and weekly tasks compared to the opposite one. The process of producing this weekly plan was to be mapped in greater detail. At the time of writing, this work was still in progress.

Improve Maintenance Management System and Coach

As mentioned previously, projections into the future demanded a higher degree of equipment availability and reliability. Considerable time was invested in working with the mobile maintenance teams. Assistance was provided in the development of their budget, KPIs, closing the PDCA loop in daily and weekly reviews, replacing a duplicate manual shift log with a single electronic one and more.

CONCLUSIONS - WHAT WORKED, WHAT DIDN'T WORK AND WHY

Evolution's strategic decision to operate under a decentralised model allows each operation (within certain boundaries) to undertake actions focussed on that particular site. These actions deliver on stretched targets which allow Evolution to disseminate the individual sites' successes across the wider group, as appropriate. The project's improvement processes were strong drivers contributing to the overall success the operation has enjoyed over the past four years. Future work will focus on driving the ability to develop these systems internally and keeping the attitude of continually seeking improvement.

+ What worked well? Why?

- The philosophy of starting with the end in mind, determining the business processes that are required to achieve the objectives, then choosing a technology that will enable the process as frictionless as possible and finally training and coaching the people to use it worked well.
- Just like a house renovation can be executed more effectively and efficiently if a master plan is developed upfront, developing an operations management system (our vision for the future) provided a blueprint for the teams to pursue. It allowed them to track their gaps against the previously agreed ideal and adjust their plans in an effort to achieve the desired outcomes.
- Technology is an important part of mining and management in general. It is important to keep an eye on technology for opportunities to help solve problems, but always understand the problem first and seek solutions through business process and people. Only then look for the technological enabler.

PDCA Mine Management System

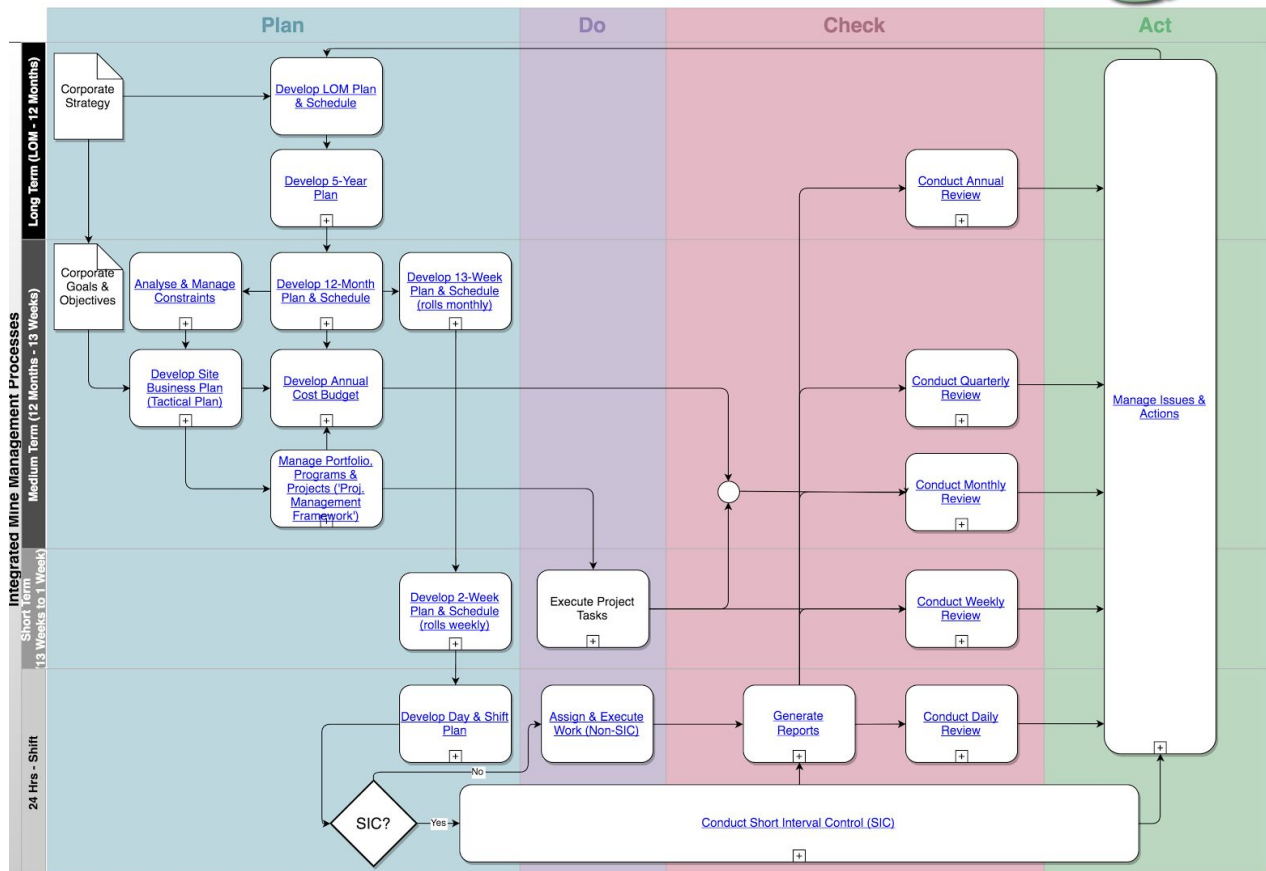
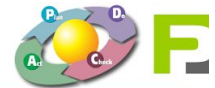


Figure 12: First Principles Consulting's generic PDCA Mine Management System

- Change Management (CM): Actively working with the Early Adopters is a great start, and they need as much support and encouragement as possible. Then, helping the Early Majority becoming successful seemed to win the game

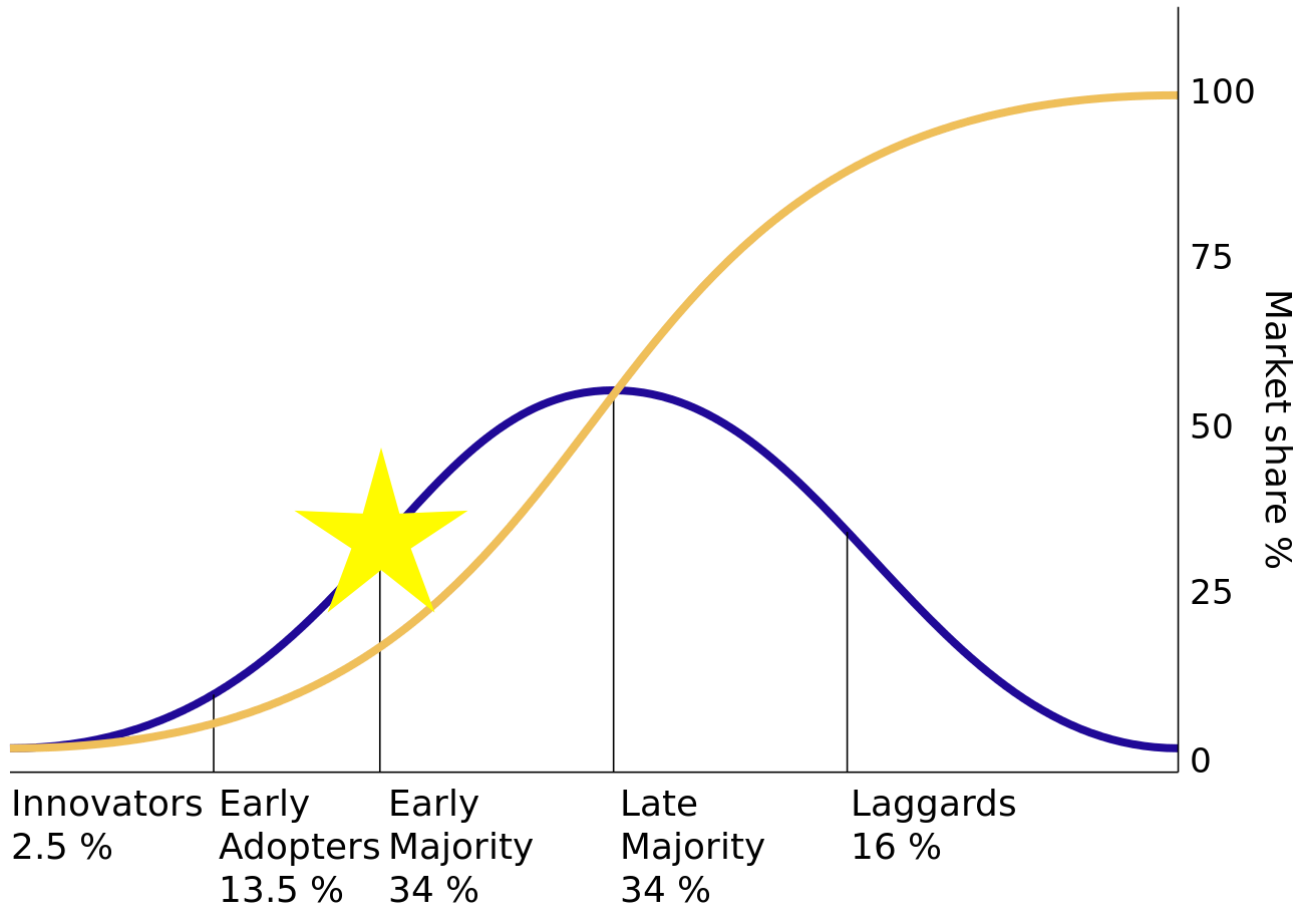


Figure 13: Maloney's 16% Rule: Project team applied this philosophy when rolling out large changes

△ *What didn't work so well?*

- Project Management Framework did not stick the first time round and we have not tried since. Possible reasons include not having a clear process owner and/or a champion and it might have been too much too soon.
- Actions triggered by variances, risks or issues are still only managed informally. There seems to be a strong cultural legacy to logging actions in a formal way. It is possible that previous leadership aimed retribution at personnel under a similar scheme. It is worth continuing this pursuit.

Why and what did we learn?

- Care must be taken of not introducing too much too soon. Instead of developing and deploying a flawless process it's better to put a rudimentary solution in place and improve on it incrementally. That said, it can't be too rudimentary or it will also fail. The key is in finding the right balance and resisting temptation of seeking perfection too early.

- While almost all upgrades introduced became part of the MRO way of 'how it's done around here', outcomes may have been even better, faster and more robust had there been a champion assigned to the project(s) and implementations.

ACKNOWLEDGEMENTS

The authors would like to thank Evolution Mining Limited for allowing this paper to be submitted and for supporting the process.

Furthermore, this is a good time to acknowledge the tireless commitment of the operations and project teams; without their willingness to explore new approaches to old problems, persistence to work through glitches until they were solved and a healthy sense of humour none of this would have been possible.

Moreover, the authors would like to acknowledge Evolution's corporate team for providing the freedom to pursue an improvement project of such nature.

Finally, the authors would also like to thank Patrick Mullen for his contributions, plus Kate Hobbs and Donna Kelly for reviewing and providing good impartial feedback.

REFERENCES

Rogers, E. M. (1962). Diffusion of innovations. New York: Free Press.

FIGURE CAPTIONS

Figure 1: Mt Rawdon Mine Open Pit – January 2016

Figure 2: Weekly Meeting Process Change

Figure 3: Screenshot of MRO Weekly SLT Meetings agenda and communications after Trello implementation

Figure 4: Monthly Focus Meetings

Figure 5: End-to-End Value Chain process map

Figure 6: Rolling wave scheduling approach

Figure 7: Example of Trello card representing a production deliverable

Figure 8: Screenshot of a daily review meeting dashboard

Figure 9: End-to-End Value Driver Tree (VDT) including all production and functions

Figure 10: MRO Value Chain or 'Speed Map'

Figure 11: Screenshot of MRO SLT weekly review meeting Trello board

Figure 12: First Principles Consulting's generic PDCA Mine Management System

Figure 13: Maloney's 16% Rule: Project team applied this philosophy when rolling out large changes