

Staying in the game – the importance of engineering based decisions

Peter Fairfield

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Abstract

This paper reflects on the author's experience working in site based technical and management roles over a 29 year period, and the past 12 years in internal and external consulting roles. It discusses the author's experiences and observations of operations management and the significant value of the technical specialist's role in providing management with information on which to base tactical decisions which may or may not be part of a defined strategy.

The landscape of mine management changes with the cyclical nature of commodity prices driving operating and capital prudence, as operations change their focus from expansion and growth to staying in the game. The role of the mine manager and management team in navigating through these changing times, attitudes and stages of the project life can influence the success or otherwise of many projects.

Technical knowledge is one of the key drivers in realising or destroying the value of a project or operation. As managers focus on people management, management systems and processes, recognising and understanding of the value in the underlying technical knowledge and getting back to the fundamentals/basics can be overlooked. In reaction to the fluctuating commodity cycle, managers implement changes through optimisation, fast tracking or parallel streaming, expansion projects and changes in the application of technology. These responses occur against the background of changes in the appetite for risk, acceptance of project uncertainty and changes in personnel which result in a loss of knowledge and experience – often at critical times.

This paper shares the author's experiences and lessons learnt in dealing with and observing these issues. The author questions whether we really understand our projects and are valuing the most important asset, our people, and in particular, the technical specialist and their experience and knowledge.

Introduction

There was a good reason at the time ... I just can't see it now!

As I moved around in my career, I always hoped that the skeletons left behind the door didn't have too much of a negative impact. As I visit various sites and projects in my current role, I sometimes wonder why certain decisions have been made. I then reflect that if the decisions were not made at the time, the project may not have survived; there's wisdom in staying in the game in order to win the game. This paper reflects on my experiences, including mistakes, and observations over the years, the importance of knowledge-based decisions and sets some challenges for future mine managers to consider.

Background

Over my 29 years in the mining industry, the role and responsibilities of mine management and the operations themselves have changed. This is particularly true of the team supporting mine management.

As an enthusiastic young planning engineer with a few years of experience, I took what I thought was my great innovative idea to the mine superintendent. He looked at me, smiled and said, "The last three times we tried that, this is what happened. Go away and come back when you have a better idea". I left with my tail between my legs and returned slightly battered to fight another day. I had learnt a valuable lesson – I was surrounded by an immense amount of experience and knowledge; Senior Planning Engineers with over 12 years and a Mine Superintendent with over 30 years of mining and people management experience. That knowledge and experience was also there to support the mine managers and, when I first started, the assistant mine managers.

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Current day mine managers, often surrounded by less experienced mine superintendents and technical staff, face a growing list of tasks that distract them from preparing and critically assessing the basis of the production plan and then delivering on the promise". These tasks include increasing human resource/management issues; increasing governance and reporting requirements; change management; centralisation and de-centralisation of support staff and the challenges of a fly-in / fly-out culture. These additional roles are largely aimed at putting the shine on the asset and achieving the corporate targets.

The challenge today is to run operations that are leaner and smarter. With the boom-and-bust, cyclical nature of our industry, we need to react and implement change, but are we sufficiently informed to make good decisions in these times? Are we really working smarter? We do have fewer people on site, but is this lack of support (particularly technical) costing operations on the bottom line through ill-informed, "lazy" decisions?

There is no doubt that during the recent boom, the mining industry has seen a skills shortage. This is no longer the case, and there are a number of highly skilled and proficient people out of work. The boom triggered a rapid progression of people through the system, and staff were at times being placed in positions beyond their level of experience, though not necessarily beyond their competence (Coombes, 2016). They simply had not had the level of training and on-the-job experience required to undertake many of the roles. This is equally true for technical and non-technical staff – do we still have "miners" or do we now have "operators"? We have created a disconnect between Mine Geologists and Resource Geologists, for example, who examine photographs of the face rather than spend time doing underground mapping. Production Engineers and Planning Engineers have been put on opposite swings for coverage, or taken off site as a result of centralisation, so they can be more efficient with their time and support multiple operations. But are these people and is this structure adding the best value to the project?

This leaves the mine manager, as the figurehead of the operation, in a challenging position, particularly if you subscribe to the notion that one is only as good as the people around you.

Is there a loss of real understanding of the orebody, mine and operation and the reasons behind why things are being done a particular way? Are we really making smart and fully informed decisions?

In the current challenging times, the pressure increases, and it appears many operations can't afford to maintain an adequate level of support. From the author's experience and observations, it is suggested that as an industry, we can't afford not to have this support, as we need to be making the right decisions. We need to be doing the right things ... even if we do them badly. Rather than simply focusing on the being the best, we need to focus on what we are doing. We must maintain a culture of identifying the right things so that we can try and "do the right things right" (Hall and Hall, 2006).

The challenge lies in that the value that could be realised from the work we need to embark on cannot always be clearly defined. Often the hidden, in-built cost of getting it wrong outweighs the additional cost to get it right, but it's not possible to accurately determine this cost. The author was challenged to quantify the performance and productivity improvements that can be achieved; value that is lost as a result of issues raised in this paper. This in some way symptomises the culture of the industry. The focus is on justifying doing the work rather than acknowledging that it is a cost of doing business and not a "nice to have" and allowing the issues to be fully explored so that potential solutions can be identified, even before the value has been determined.

The Changing Face of Operations

The nature of organisations has changed over the years from the large scale "breeding grounds" such as Mt Isa, Broken Hill, West Coast of Tasmania, and the Kalgoorlie/ Kambalda regions to name a few, with their long mining histories and development of technical and operational staff, that then spread to establish the

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smaller regional centres and ultimately the commencement of fly-in/ fly-out in the 1990s. Each region had its own parochial nature and a unique set of system and processes. People were trained in these systems and processes and progressed methodically and slowly through the system. Each employee had a role, technical knowledge was valued and the author notes that a number of today's current leading technical experts cut their teeth in one of these early "breeding grounds".

The stability of the workforce in these operations may have been a challenge and frustration for overly eager, enthusiastic engineers at the time, but the training ground provided a level of technical and experiential support for the budding technical specialist to be guided and to learn from the lessons of the past. The level of work, detail and understanding of the operation from a technical and operational basis, was significant. Time was spent analysing data, not just collecting it. At the time, collection of data in itself was challenging, so that there was a clear focus on what was needed and relevant data was meticulously recorded. These long-life operations had been through and survived many mining cycles through the application of the collective knowledge. What was taken for granted at the time was the depth of support provided to the mine manager and decision makers by those with sound technical knowledge and extensive practical experience.

Importantly, the value of those technical staff who wanted to be technical engineers/ geologists/ metallurgists, not shift-bosses/ operators and managers, was valued and there was a clear career path for all concerned.

In today's climate of lean structures and fly-in/ fly-out operations, I see the mine manager, or his alternate, having to make key decisions in the absence of this highly trained, experienced and stable support network. However, the expectation from above is that the manager will get it right, first time – this was the clear, underlying theme of the author's first management training in the late 1980s.

Often there is an expectation placed on smaller/ shorter life operations that to run the operation, fewer people are required. Such operations can be more challenging to run and require a greater level of understanding of the asset. Due to the shorter project life, there is typically less optionality and reduced ability to tolerate deviations from plan.

The challenge to the industry is to re-establish, or where it already exists, maintain, the recognition of the value added by technical specialists and experienced workers in an organisation. It may be prudent to better engage them, and in some cases, retain them to support mine management. At one operation the author has visited over a number of years, five different mine managers were cycled through, none of whom could deliver effectively. It wasn't until the fifth one engaged with the technical specialists to help solve the underlying technical issues that the operation began to perform to plan. No amount of polish could be applied to make it shine without getting to grips with and solving the technical issues directly.

Behaviours

After the exploration team and geologists begin to depart in the face of an economic downturn, and after technical construction/ support staff leave due to cost pressures resulting from an extended construction/ ramp-up phase, the technical specialists start to get nervous as they anticipate being next in the cost reduction process. This paper does not address the issues behind the perception of project failure, but will draw attention to the technical changes that occur during construction and the project life.

Most military people will state that a battle plan does not survive first contact with the enemy. Drawing on this analogy, how many designs and schedules remain unchanged after first contact with construction and the orebody? How well prepared are our organisations to critically review, assess and deal with the technical problems and how are issues assessed prior to implementation?

As the pressure to continuously improve and/ or turn an operation around increases, is the focus on the right metrics? In the face of inherent variability, do we have time to address the volatility in performance and understand reasons and assess the metrics relative importance to success? Are we solely focusing on the immediate outcomes and the end game, rather than the critical enablers and drivers?

What are the right metrics? Do we understand the operation well enough to be able to identify the right metrics? To every question, there is a simple answer that is invariably wrong. Is it as simple as getting the development in and production will follow, or chasing high grade? In the author's experience, there is no single answer, it varies across operations and over time at each operation. Insufficient time and corporate

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support to allow the identification, assessment and management of the drivers will limit the ability to identify what success can look like and to achieve sustained success.

The reality is often the value that is not being realised, where the focus needs to be, is unknown, and evaluating the effectiveness of the plan is therefore not adequately understood. We are unable to define the time, effort and cost that should be applied to identifying and implementing the solution.

The feasibility study anchor

The Author has often been confronted with trying to answer the questions *“But the Feasibility Study said ... are you telling me it is wrong”*. As a company employee, the career limiting answer to that question is, yes. As a consultant, the challenge is answering the question so that the relationship is not compromised. After a few battle scars, I've learnt to say that the feasibility study was right at the time, but things have changed, more has been learnt and something does need to change.

If you survive first contact and successfully walk out of the office after answering the question, the next challenge is to determine what needs to be done and look around and see who is there to do the work. If things have not been going well, typically there is no-one on site with the time or expertise to do the work and the status quo remains. The manager must continue to optimise and rationalise so as to stay in the game, rather than assess the problems and make technical changes to address the fundamental issues.

The manager is then faced with the dilemma of what to change and whether to ask for help and potentially appear incapable. If the manager does seek help, should a consultant be engaged or the centralised technical services team be used? The decision at times is the lesser of two evils rather than embracing the value either party can bring. The next challenge is how the relationship between the manager and the selected support is managed and maintained and how the technical/ operational changes (if required) are implemented.

At first impression, reducing manning levels may be good for the cost side, but it comes at the expense of project implementation, efficiency and the technical development of professionals in the industry. Much like stopping exploration and resource definition drilling is the start of the decline of project life, failing to invest in the technical staff on site has a negative impact on performance at site level, and more broadly, on the industry as a whole.

At times, the reduction of staff and re-structuring exercise can be followed (or triggered) by the appearance of management consultants tasked with looking at ways to fix the project. Management changes generally create a challenging culture on site which needs to be managed. The author suggests that while it is important to acknowledge that both management and technical challenges need to be addressed, in the author's opinion, less attention is being paid to the underlying issues driving the poor performance and resulting in decisions that lead to ineffective operational management structures.

The centralised versus de-centralised model

As the size and strategy of organisations and sites change over time due to cost pressures and management trends, so too does the need to retain full-time, site-based technical teams to assess new opportunities, progress projects through the approval process and provide life support to often under-resourced operations. This resulted in the model of technical teams providing technical support to a number of operations in a centralised hub. These services may come at a lower cost to the business, not necessarily more cost effective, and the model enjoys varying degrees of success based on the culture of the site and centralised teams. Often as the centralised teams are beginning to bed down, develop relationships and impart value, the services are then de-centralised and taken back to site, due in part to changing economic conditions and/ or a new corporate structure.

The contractor/ consultant model

The industry has created the contractor/ consultant market by cutting staff in the tough times, only to bring them back on a part-time or casual basis. These contractors / consultants either set themselves up as sole traders/ teams or join larger consulting firms. More often than not, the reality is that while the technical work must still be done, the corporate culture does not see the value of a full-time role.

In the absence of the technical skills within the organisation, the operation becomes increasingly reliant on the contractor/ consultant to provide the ongoing support and indeed, the corporate knowledge, of why things

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are failing, what has been tried, what has succeeded, what needs improving and why, and increasingly, where the information is stored. This is even more evident in fly-in/ fly-out operations.

Case Studies

“But the Feasibility Study said” and *“conventional thinking says we can’t”*, are perhaps two of the hardest myths to break. The utopia of implementing a project as defined in the feasibility study is something very few in the mining industry have had the pleasure of doing. We are either struggling to achieve the original goal or pushing to implement production increases to achieve stretched targets – either way, the feasibility study is very rarely followed.

The author has observed a large company’s operation, which had centralised technical support services, struggle to implement the project’s feasibility study goals. For a variety of reasons, the operation’s struggle to meet performance targets resulted in cost blow-outs and the inability to deliver the metal production targets against the plan. Unfortunately, cost over-runs and a production shortfalls inevitably tend to go hand in hand. The organisation adopted a centralised support services model and a lean, site-based team. Over time, the site-based team became even leaner through attrition, initially enforced, then natural. This led to less well considered decisions being made; it’s often observed that it’s not the people *on the ship* that cause it to sink, it’s the ones that get off.

The challenges to make the right decisions to stay in the game and keep the operation cash positive were real, but so too was the fact that implementation of the feasibility study plan was not going to be successful and the mine plan needed to be changed. Although the site team was well experienced, the constant pressure to deliver led to a lack of focus on the development of technical solutions to fundamentally shift the operation’s ability to meet achievable and profitable performance. The organisational culture led to a less than adequate integration of the internal resources that were available to assist and support the site team to address the technical issues affecting the success of the operation, infrastructure location and mining sequence. After a period of time, the risks that the design basis were developed to mitigate had not transpired, but the operational and design constraints remained and change was not considered. All the while, production and performance pressures resulted in regular site management changes which continued to have an impact on the functionality of the organisation and the site-based and centralised teams.

The instability and constant changes led to a lack of confidence in the team from senior management and also a lack of confidence from within the team itself to make and implement the changes that needed to occur. A continuation of the approach would most likely result in financial and project failure.

Eventually, the site and centralised teams were driven together through corporate change. The same individuals prepared and implemented a revised case that has proven to be successful and the operation performed at production levels above those estimated in the feasibility study, but it was certainly not following the plan outlined in the feasibility study. The changes in staffing levels and personnel saved costs, but it was not until the technical solutions were developed and implemented that the productivity and revenue side of the operation began to improve. During this period, the lost opportunity outweighed the cost savings. The technical changes (revised plans) were based on the experiences and conditions on site and largely went against traditional convention – the anchor chain was cut. Over time, the revised plans were modified and refined by an increasingly larger, more stable and experienced technical team. With the success, confidence grew, as did the support for additional resources to further assess and implement changes to seek and implement continual improvements.

Should we conclude that the feasibility study was wrong? If the intent of the feasibility study was to secure funding to enable a project to be progressed/ constructed, then it was great success. What went wrong, or what can be improved upon and learnt from the experience is the recognition that we must continually assess and learn from technical experiences, and not be afraid of change and making bold decisions. In fact, the decision to proceed based on the feasibility study was a bold decision that, at times, did look like a bad one; however, the development, implementation and continual refinement of the design and operational practices has led to a very successful operation in a challenging technical environment. Any investors who had the courage to stick with the company throughout the process would have been well rewarded financially.

In another case study, the author has observed the turnaround of a small and, at the time, marginal operation in a non-traditional mining district with a chequered past. Some four years later, the operation is

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solidly cash positive, has developed a new orebody and is exploring for another – all driven by a greater technical focus and understanding. My first involvement was to provide an independent view of the current practices and the team's ability to deliver with less variability in performance and overall lower unit cost.

Having been called to site by senior management, I expected a frosty relationship and a great deal of scepticism from the site team.

My first impression was the pleasant surprise at the number of technical staff on site; significant for a struggling operation. Development targets were not being met and there was much angst about mined grade not meeting resource model grades. In short, they were not meeting expectations, but some upwards management of the expectations was also required. I wasn't able to provide senior management with anything they hadn't already heard and didn't already know, but perhaps hearing it from an independent person gave them greater comfort in the capability of what was a relatively young site team. I was also able to re-affirm to the team that they were employing good practice and sound judgement. As a side note, quoting from a mentor, "We strive for *good* practice, there is no such thing as best practice".

In the absence of a corporate structure and a centralised technical team of a large organisation to draw on, I observed the young team embrace the contractor model of providing support and training to the team and engage with consultants in an effective/ co-operative manner to provide specialist support and services, as well as to train the site team in the skills and techniques being applied.

At the time of my initial involvement, the entire team fully appreciated that they could not afford not to seek and embrace external assistance. They have now reached the point where the level of support required from external sources is reducing and the technical team are being poached to go to other sites within the organisation. The team implemented a number of technical changes having developed a greater understanding of the deposit/ operation led to improvements in the operational performance of the mine. Specifically understanding the constraints and developing planning and operational technical systems and processes to generate and implement the mining plan. The improvements, apart from reducing unit cost, have generated greater confidence in the team at a corporate level. This has resulted in greater financial support and allocation of capital funds in efforts to extend the life of the project.

This would not have been possible without the support of the senior management team and the behaviour of the site team in embracing that external technical support. The support included the engagement of technical support and commitment to exposing the site team to relevant training, personal and professional development. Without such managerial/ corporate support, the site-based team would not have been able to deliver the outcomes that it has, and the operation would have struggled to remain viable.

The author considers the operation to be one of the more efficient and well run operations visited, as well as one of the most enjoyable places and group of people to visit and work with. The team has remained largely unchanged; the value added to the operation is being returned to them by the company in professional development and satisfaction.

The delight of walking through the front gate and seeing a large surface stockpile was soon forgotten when the reason for its presence – hardness and poor recovery – was understood, and the queue of trains behind the process plant was pointed out. Mineralisation changes in terms of grade, hardness and oxidation state within deposits need to be understood and continually managed to ensure optimum performance of the process plant. The preparation of geological based models to define the key characteristics that drive metallurgical performance, (throughput/ recovery) and integration of these to prepare an optimum production schedule is often considered too hard, unattainable and to be the domain of the backroom boffins. But without this work, the delivery of metal targets through improved process plant performance would not have been achieved.

The two-way interaction between all technical disciplines' attention to this "non-productive" work was critical to the success of the operation.

Conclusion

The author's experience has reinforced that in order to get the most out of our projects, we need to understand and continually review the technical aspects and drivers of value. It is true that we must focus on systems, processes and people, but we must ensure we retain the presence and skills of the technical

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people in our industry who support those tasked with making what they consider to be the best decision at the time. The action plans may not be optimal, and in fact, probably won't be, but unless we have the resources and skills to enable the projects to be fully understood, our projects will continue to struggle to perform and will lead to further reductions in value, returns to shareholder and investors leaving the industry.

We are currently experiencing a period of significantly high unemployment, and highly skilled people are leaving our industry – this, at a critical time when we are looking to improve performance of our operations. The author considers these improvements are best and sustainably introduced and achieved by holistically understanding the technical issues and developing technical solutions. This will require professionals to embrace the various organisational models and structures that are encountered in various organisations.

As an industry, we must challenge ourselves to re-focus on the most important asset – our people – and retain and develop technical skills across the industry. This will in turn attract new people to enter the industry. The recent boom created many opportunities for staff advancement and has had some positive impacts on professional advancement, but this may at times, have been at the cost of professional development.

To navigate through the current 'bust', we must be creative in our thinking and approach. This applies to how we structure our organisations, remunerate and value the people working in our industry.

Cutting so-called non-productive technical and professional people is not the answer when we acknowledge that we must get smarter in what we do. By understanding our assets and doing the smart things, we will improve the quality of our output, and ultimately improve performance of our assets and the external perception of our industry.

Most importantly, this will attract and retain investment levels, which will lead to security and stability of our industry and provide the environment for fostering and developing our technical, professional and operational staff.

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The willingness of people in our industry to give and share the precious resource of their time should not be underestimated. It is one of many aspects that make our industry such an enjoyable and rewarding one.

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