

# Transforming Mining - A Framework for Dramatic Changes in Performance

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## ABSTRACT

The mining industry has been slow at adopting the latest management philosophies from other industry sectors, such as manufacturing, and in retrospect, with good cause. With the plethora of three-letter-acronyms such as TQM, JIT, TPM and now, BPR each touted as the panacea for profit improvement, you wonder if you must choose one or attempt to embrace them all! In truth, each new insight into organisational behaviour bears some investigation. This paper looks at the underlying principles and elements of successful change strategies, and how several mining companies, including coal mines, in Australia, Chile and Canada, are applying these principles to their operations. These examples illustrate the need to think radically, and to view mining as an overall process delivering value to the customer rather than a collection of functional silos. They also show that often, a continuous improvement initiative is not enough when a fundamental redesign, a paradigm shift, is needed for a performance breakthrough.

## THE CHALLENGE

The coal mining industry is again facing a time of uncertainty and challenge with many operations scaling back operations in the face of weak coal prices and high costs. Unfortunately, the outlook for the future is not much better:

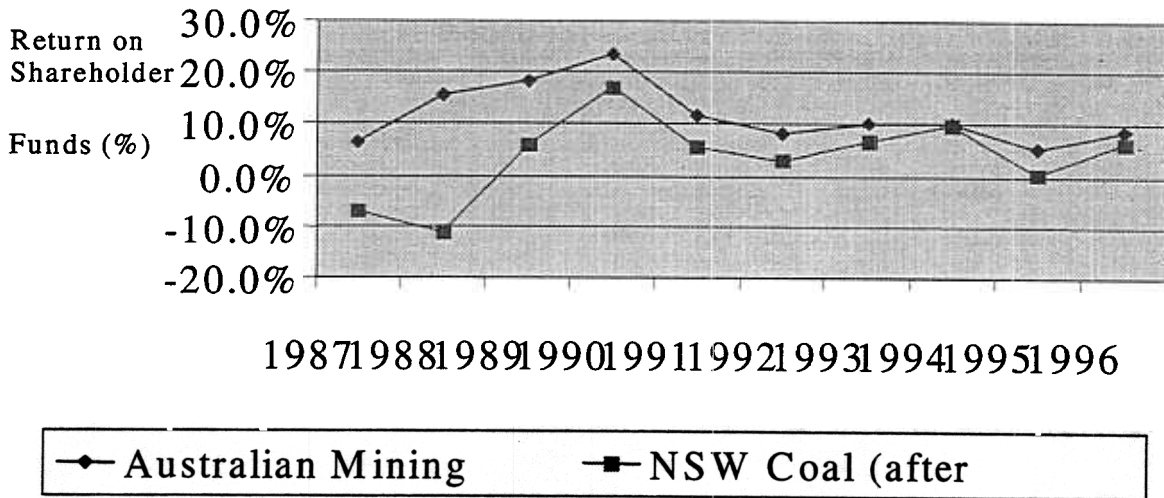
- Global competition is increasing, particularly in the steaming coal markets. By the year 2000, six of the largest export coal mines will be in Indonesia, Columbia and Venezuela. These mines are expected to have combined exports of almost 65.8 MT.
- Costs are high. In comparison to its competitors, costs at Australian coal mines are among the highest in the world driven by high labour and other site costs, and are much higher than the low cost producers in emerging countries where FOB cash costs are in the order of \$US 22-23 per tonne.
- Commodity prices are static and falling in real terms; since 1980, coal prices have declined by an average of 4% per year. Over the next several years, supply is likely to keep up with demand for both coking and steaming coal providing little incentive for upward price moves. This is despite expected strong growth in demand for steaming coal due to the number of new thermal power stations coming on line in Asia.
- Returns to shareholders are low. A survey for the NSW Minerals Council revealed an average operating profit in 1995/96 of \$2.61 per tonne; this equates to a 6.2% return to shareholders (Coopers & Lybrand, 1997). By comparison, the average return in the Australian mining industry is 8.8%. Forecasts for 1996/97 project a loss even though governments and employees still make exceptional returns. The long-term trend is illustrated in Fig.

On the positive side, growth in the thermal coal trade is expected to remain strong and opportunities exist for Australian coal producers to expand production and increase exports. This requires, however, that the industry is competitive with other suppliers, particularly those in Indonesia and the United States. It also requires that the return on funds employed be sufficient to attract the capital investment needed to develop and expand operations.

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## Industry



**Fig. 1 – Historic industry performance**

These developments pose a challenge, and it is clear that significant improvements in productivity and profitability are required. At the same time though, traditional improvement approaches are either not delivering lasting change or are merely allowing operations to keep pace with the leaders. This is particularly true of Enterprise Agreements where promised results have, in many cases, yet to be achieved, and of technical advances where equal access to technology quickly means that, everyone has access to the same benefits. Productivity improvements, due to technology, are on average 5-9% per year.

The question is therefore “How do we achieve a fundamental change in the way we do things to provide superior returns to our investors and secure long-term job security for our employees?”

### Strategies for change

The answer unfortunately is not simple. As people probably suspect, there is no “silver-bullet” to miraculously solve the problem. We need instead to look at how work is performed across functions in order to make these operations more logical, effective and efficient. At the same time, we must also address the human aspects through effective leadership, a clear vision and targets, and individual and team development. Thus, by addressing the business in a holistic sense, we can bring about the improved performance and productivity required for a sustainable future.

This holistic strategy borrows on the concepts of business process reengineering (Johansson et al, 1993), change management and, more recently, corporate transformation (Gouillart and Kelly, 1995). However, in borrowing these concepts, it has been more to explain and provide a framework for our experiences and observations on what works and what doesn't work in the mining industry rather than to provide a cookbook recipe for change. The elements included within this strategy are as follows:

- Achieve motivation and commitment;
- Create the vision;

- Build the measurement system;
- Develop a detailed understanding of the coal supply chain process;
- Redesign the work processes and infrastructure;
- Develop teams and individuals; and
- Align reward systems.

Implementation is not a sequential process but is achieved by working simultaneously, although at different paces, on all elements. Before we discuss these elements and implementation in further detail, it is worthwhile to review some of the successes mining organisations have had applying these concepts.

- A coal mining company has recently targeted improvements in its production, mine planning and maintenance processes, and is forecasting an increase in production of over 30% in 18 months without increasing the workforce.
- A iron ore mine reduced train cycle times by 20% resulting in deferring a planned \$150 M capital investment in new consists; the capital was spent instead on upgrading the fleet of locomotives.
- A copper mine re-engineered the sequential, iterative and time consuming process of new mine development, to a collaborative, concurrent process achieving a "time-to-market" capability of 30 months.

The issues, actions and techniques applicable to each element required to achieve these benefits are discussed in further detail in the following sections with illustrations drawn from examples in the mining industry.

### **Achieve motivation and commitment**

It is understood that achieving anything significant, including a fundamental improvement in mine productivity, requires motivation and commitment not just of management but of the entire work force. This requires a combination of top-down leadership and bottom-up involvement to create a groundswell of change led by middle managers and directed/coached by senior managers.

First, it requires the active involvement of senior management in the organisation with their staff to arrive at a common understanding of the need for change and the way ahead. This is the most challenging step as middle management often has the most invested in the status quo. They've developed the systems and procedures under challenge, and are in the position they are in because of current systems. It therefore requires concerted effort, through workshops, meetings and one-on-one sessions, to gain their commitment to the planned changes. At one operation, we facilitated a series of workshops over a week long period involving Managers, Superintendents and selected Supervisors to evaluate the issues in the coal supply process from drill & blast through to coal processing and train loading. Once the essential issues were defined, actions were identified, prioritised and responsibilities assigned. These workshops followed a detailed diagnostic and allowed the staff to discuss and debate the issues and thus begin to own the change process.

Second, mechanisms are required to engage the work force in the process, and in a two-way dialogue on what's required and why. In the past, organisations, such as Hamersley Iron, have employed continuous improvement teams to begin focusing people on looking at processes, customer requirements and quality/cycle time issues. More recently, a coal mining client of ours has been successfully using a series of workshops, as part of its certified agreement implementation process, to focus work teams on their code of behaviour, team skills, customer requirements and improvement opportunities.

Both of these activities are required. Many TQM efforts have failed because they lack guidance from the top, that is, teams focus on trivial issues, generate impossible to implement recommendations or fail to adequately tackle controversial issues. Conversely, management workshops and team building fail because the people who are key to the changes, the workforce, are not involved.

## **Create the vision**

The second element is creating a compelling vision that sets some ambitious stretch targets that become the organisation's reason for being. The vision should be bold enough to provoke some strong reactions and have some substance and meaning for people. Pepsi's vision, for example, is very simple: Beat Coke. In the mining industry examples of effective visions may be to:

- Be the lowest cost producer in NSW (if you are at the high end of the cost curve);
- Increase production by 30% in two years with the same labour and resources;
- Cut rail cycle time by 50%; and
- Radically change the mine development process.

These visions are much more tangible and relevant than ones often seen in corporate boardrooms or on noticeboards, such as, "being the preferred supplier of our customers". Even so, they often need to be translated into simple themes that are directly relevant to a work team. For example, for maintenance team the vision may be "zero breakdowns" whereas for an overburden team the vision may be to "keep the trucks moving". These themes contribute directly to the corporate vision but focus the team on the critical or high leverage areas within its control.

## **Build the measurement system**

If the vision is important then we need to keep score and help drive us toward the end objective. It would be extremely difficult to become a scratch handicap golfer if we didn't keep score to see the impact of changes in our golf swing or to reinforce the benefits of practice on the driving range or putting green.

It is therefore obvious that an effective measurement system is required in an operation to track progress against the vision, to reinforce positive behaviour and to highlight the impact of changes. This measurement system must do three things:

1. it must break the vision down into specific quantitative objectives and milestones so that set targets must be achieved by specific dates;
2. it must align the measures in the organisation with the vision; and
3. it must translate the high level objectives and milestones into specific measures for the work teams that reflect their visions or themes and the factors over which they have control.

Consequently, the system involves a set of inter-linked scorecards or dashboards moving from the corporate or strategic level to the teams. Fig. 2 illustrates the relationships between the vision and measures with the outcomes at the various levels in the organisation. At one operation, we have designed a system based on these concepts. The keys to the success of this system have been:

- gaining the operators' and supervisors' trust in the accuracy and consistency of the data, particularly that collected by the mine equipment monitoring system;
- involving the supervisors in recording, tracking and discussing the performance trends with their teams on a daily/weekly basis; and
- selecting measures and setting performance targets that are linked to the expected outcomes defined in the strategy.

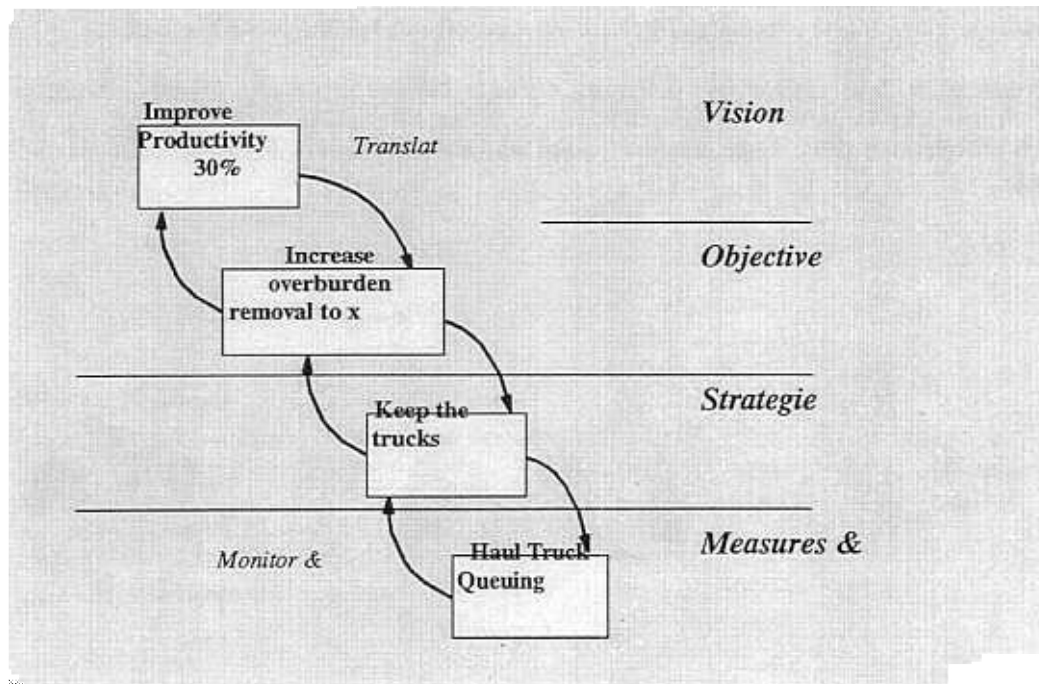


Fig. 2 - Relationship of vision to measures

## DEVELOP A DETAILED UNDERSTANDING OF THE COAL SUPPLY CHAIN PROCESS

One of Stephen Covey's habits of effective people is "beginning with the end in mind", that is, start with an idea of what you want to achieve. Imprecisely defined outcomes and expectations is a common flaw with many improvement programs. Thus, they lack focus and efforts are spread across a wide-range of activities diluting the effectiveness of the initiative and quickly leading to complaints that the initiative is consuming too many resources and not producing any gains.

We, therefore, need to understand the processes within the coal supply chain and the factors that have the greatest leverage on the outputs, costs and quality of the operation. This analysis defines or calibrates the gap between what is currently being achieved, and what is technically and practically achievable – in other words the process capability. This element also provides the technical basis that under-pins the vision, and provides the route-map that illustrates how the vision can be achieved.

Fundamental to this element is a re-assessment of work methods and practices to challenge the status quo. This is achieved by mapping the important production processes, from site preparation to train loading, as well as the main support processes such as maintenance, mine design/scheduling, and order entry and logistics. The process maps identify the inputs/outputs, controls, mechanisms, and issues with each activity. The processes are analysed to understand the costs, operating cycle times and delays. From this information, internal benchmarks for equipment or machine performance are developed, and the overall process capability is defined. An example of a hauling process is illustrated in Fig. 3.

For support processes, such as maintenance, the costs, effectiveness and importance of each sub-process or activity is analysed to understand its value to the organisation and to define how well it is currently being performed. Those activities which provide high value to the organisation but whose performance is below expectations are obvious targets for improvement.

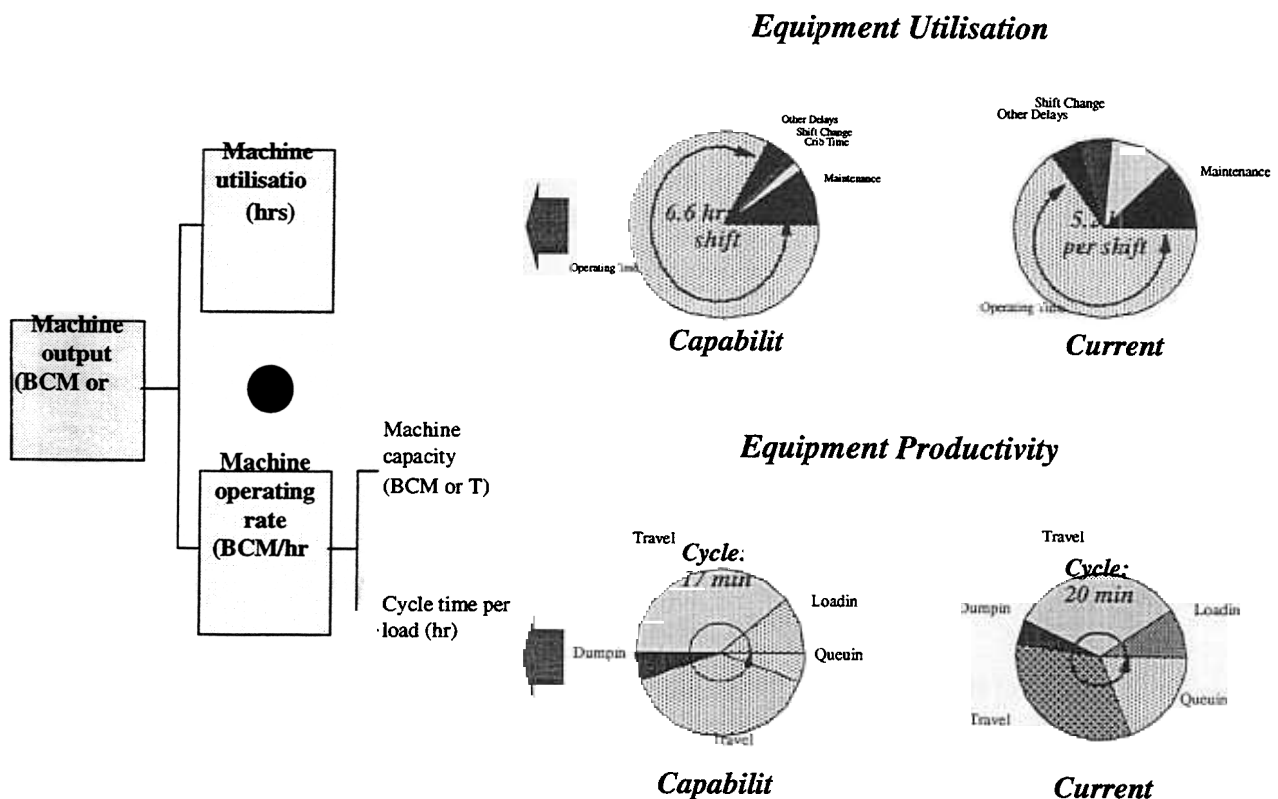


Fig. 3 -Example hauling

External benchmarking can also establish what is possible. There are, however, pitfalls with benchmarking. It is difficult to find similar operations, ie, strip ratios, geology, infrastructure, and thus the results are always open for debate. Benchmarking a small sample of organisations within the same industry may also lead to a false sense of what is considered "best-practice". For example, one small mining operation considered its maintenance performance well above average because it had "benchmarked" itself against other small operations within the same company. Actual performance was, in fact, well below average.

### Redesign the work processes and infrastructure

Many of the activities discussed up until now prepare the ground for change. The critical activities though are those leading to changes in work practices, systems and structures that deliver lower costs and higher productivity. These activities are often difficult to get underway due to organisational inertia caused by:

1. the scale of the task in terms of the amount of work to be done and the magnitude of the gap; and
2. the lack of familiarity of people with managing by fact and in systematically changing things.

The first part of the solution is to begin by identifying and then prioritising specific, concrete actions that address the high leverage areas. Each action should be capable of being implemented within a short period of time, e.g., 4-6 weeks, and should have tangible outcomes that are measurable and relate to the overall objectives. As the initial planning activities are likely conducted by a small group, the resulting actions need to be assigned to individuals or work teams so that detailed action plans can be developed. As part of this process, it is worthwhile working through with those responsible for the task the rationale behind the action, the expected outcomes and deliverables and the broad strategies to be used. To facilitate this process, a simple model is used that first defines the current or "as-is" situation, second explores the desired or "to-be" state, and third defines the broad steps and tasks required to get there.

As an example, one of the key drivers in a truck and shovel operation is the time available and used to move overburden. At one site, a significant source of lost time was shift change and crib. An action was therefore initiated to develop an effective procedure to allow the shovel and a minimum number of trucks to work through crib by staggering the crib times of the crew. The procedure was developed and tested in one crew and then rolled out to the other crews. Consequently, productivity through crib has increased to nearly the same levels at other times during the shift.

The second part of the solution is to provide people with a simple, systematic process and with some basic improvement tools and techniques. At one operation, an improvement process was designed using the following steps: analyse, plan, implement, and monitor. To assist people in understanding the process and their role, we developed a set of guidelines for each step that described the purpose, the preparatory work, outcomes, and tools and techniques available. Specific timetables were established with each work team outlining the meeting schedule, and supervisors were then coached through the process over a 6-week period.

While this element involves substantial bottom-up activity, management support and guidance are required to ensure that the work teams remain focused on key issues and arrive at practical solutions that challenge the way things are done. For example, one of the work teams recommended two alternative practices for spotting trucks at the shovel because they were unable to resolve a conflict between the practices in use by two different crews. This was clearly not the intent, and the Superintendent directed the team to reassess its recommendations and collect further data on the differences in the two practices.

### **Develop teams and individuals**

Another area that receives little attention in many improvement processes is the need to develop the capabilities of the people within the organisation. The changes resulting from the processes described above involve dramatically different ways individuals and teams work and operate. In addition, the improvements are driven and led by line management, and not through some parallel process. This not only involves the people in developing the solution who often have the most detailed knowledge of the process and inherent issues, but also provides the means of engaging people in the process to build motivation and commitment.

Managers and supervisors require new skills as their focus is no longer directing and controlling but leading and coaching. Operators and maintainers require problem solving and team membership skills. These are in addition to machine or process specific skills, such as, the skills needed to proficiently operate an overburden shovel. Training and development, for both management and the work force, are required. Of the two, training and development of management is the most challenging and with arguably the highest payback. The focus of most programs in the industry, however, is the operator or tradesperson. For a start, proficiency standards for supervisors and managers are required that address more than just the technical or statutory elements of their role. From these standards, education processes may be designed to suit the individual needs.

### **Align reward systems**

We act as we are measured and rewarded, and thus our reward systems must support the corporate vision. In many cases, these systems are in direct conflict with our vision. For example, although most organisations support planned and preventive maintenance, the people most often praised are the breakdown fitters who get things going after a failure. We

therefore need, at some point, to look at how people are rewarded and whether these systems are in fact aligned with the vision, business objectives and processes.

Within the coal industry, some practices stand out that do not necessarily support the changes that are required. These are:

- the weekly production bonuses that are based on absolute production volumes instead of profits, or annual plan or strategic targets; and
- overtime, while allowing flexibility, is often abused and encourages wasteful practices.

There is no doubt that considerable effort will be required over the next few years to develop systems within the industry that link compensation and rewards to performance.

## MANAGING THE CHANGE

While the strategy outlined above provides the framework for change, implementation requires effective program management including:

- a strong focus on results to link project objectives with business goals, and to set the criteria for success
- a flexible, layered plan that is developed with members of the team and which fixes high-level milestones and intermediate goals, but allows some flexibility in task execution
- sound organisation to adequately define roles and accountabilities and to communicate effectively what's required and why
- effective coordination and control the project to balance and commit resources, and to integrate tools for planning with reporting, and to formally monitor and report progress including taking action in time to achieve schedules
- mechanisms to evaluate the effectiveness of the plans, tactics and systems to adapt and improve capabilities

Above all, the actions and plans must be seen as an integral part of day to day operations. Therefore, all the activities on site must be integrated within an overall mine business plan. This allows the resource commitments of the often-competing initiatives to be assessed and actions prioritised based on the organisation's strategy.

## CONCLUSION

The coal mining companies today, like many others, face substantial challenges. To address these challenges and realise the opportunities that exist, organisations require new ways of doing things, and need to evaluate and adopt tried and tested approaches used in other industries. This paper proposes a framework and set of principles to significantly increase productivity, reduce unit costs and make better use of existing physical plant and equipment in order to improve the return on funds and provide for a sustainable future.

## REFERENCES

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