USING MODERN MANAGEMENT SYSTEMS TO DRIVE BEHAVIOUR TO GENUINELY IMPROVE SAFETY (NOT JUST LTIFR)

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SUMMARY

Maximising margins in today's competitive international markets demands superior safety and productivity. By far the greatest determinant of productivity and safety is managerial and workplace culture defined by the combination of people's behaviours and attitudes.

Unfortunately traditional managerial systems drive sub-optimal and even counterproductive managerial behaviour. Increasingly this is being recognised in the measurement of safety primarily by Lost Time Injury Frequency Rate as well as the measurement of costs and productivity using archaic systems.

While some organisations honestly strive to provide people with working environments and systems enabling superior performance, relatively few recognise the primary need for changing executive and managerial practices. Many organisations are anchored to the past.

In attempting to lead change, many managers rely on the common approach of merely increasing training and communication to change people's attitudes. This approach is based on the incorrect assumption that attitudes drive work practices (behaviours). This fails because in a work or social group attitudes do not drive behaviours.

Instead, the reverse is true. Operators and managers develop attitudes through experience – and in particular through behaviour which drives attitudes. Thus, to change work culture, executives need to first change what they and their people do.

Importantly, systems drive behaviour. Thus, to change managerial and workplace culture, executives need to first change what they do. Executives need to implement simple systems to drive desired behaviour which will then develop appropriate management and work place culture. Only then can real change be sustained.

This paper focuses on modern measurement, analysis and reporting systems which are by far the most powerful drivers of behaviour - and crucial for increasing accountability.

These simple methods require no additional investment and produce substantial, sustained performance improvement.

INTRODUCTION - SOME FUNDAMENTALS FOR IMPROVING SAFETY AND PRODUCTIVITY

Firstly, improving productivity and safety boils down to:

- identifying what to change using correct Measurement, Analysis and Reporting systems,
- applying a systematic methodology for improving operating and commercial processes,
- changing people's behaviours and attitudes to build a new work culture for ongoing improvement

This paper covers all three topics.

Process thinking combined with results orientation

Secondly, before examining why many managers and executives fail to achieve significant lasting changes in managerial and work practices, please consider the following important note.

"To improve results, first improve processes!"

Many managers state obvious agreement with this principle yet unfortunately their systems often prevent them from complying.

A process is defined as a series of (usually) repeatable tasks. There is a wide variety of production, commercial, marketing and administrative processes in mining.

An obvious example is the breakage of rock in underground roadway development and production faces. In these processes, outcomes are measured in metres or Tonnes together with dollars and ore quality. Ore treatment processes also have outcomes with similar measures.

Other less obvious but important examples include processes for relocating production mining faces (and their equipment) and processes for providing maintenance, clerical, marketing and commercial services. Such processes have outcomes measured in time, dollars and work quality/efficiency.

A less tangible but very important example includes management processes such as planning where outcomes are measured in speed and quality of making decisions and providing information.

To improve organisational performance, one fundamental is to think in terms of processes. Overall business margins do not improve through needless or wasteful investment in higher capacity capital, slashing indiscriminately at cost structures, wishing or simply shouting for better performance. Sustained improvement in margins requires sustained changes to the processes that produce the results. It requires process thinking.

Obviously it is vital to focus on results - including Lost Time Injury Frequency Rate. Unfortunately, to do so without understanding the drivers of the results and the process which produces the results can lead to apparent short term improvement in results with detrimental impact on the process and medium/long term deterioration in results.

Costs and incidents are outcomes

Using a combined results and process focus costs and safety come to be seen for what they really are - outcomes. After all, inefficient processes including those with artificial restrictions imposed by unions or managements will produce high total cost and high unit cost. Efficient processes will produce low total and unit costs. Hence, to improve total and unit cost, improve processes!

Similarly, safety results are seen as outcomes. Processes with high risk including those with needless risk created by obsolete union or managerial practices will produce high incidence of injury or loss. Safe processes will produce minimal or zero injury or loss. Hence, to improve safety, improve processes.

What is productivity and how should it be measured?

The basic unit of measuring productivity is not Tonnes per Man Year or similar measures. This is a measure merely of labour productivity.

The only real measure of productivity is unit cost of producing saleable product at the desired customer specifications. This measure includes the cost of all resources including capital, time, materials, equipment and people's efforts.

Productivity refers to the efficiency of converting input resources to saleable outputs. In essence unit cost reflects the efficiency of converting inputs to outcomes for sale to customers.

Genuinely improving safety improves productivity

Obviously, accidents and unplanned incidents are examples of waste. As such they are the enemy of productivity. This is proven by the strong correlation between excellent genuine safety performance and productivity. After all, when waste is eliminated within a process, productivity increases.

Safety and high productivity are not mutually exclusive. They are complementary.

Safety should not be dealt with in isolation. It needs to be considered as one of many important results and is best managed in conjunction with other factors involved in improving processes.

Now, let's discuss why many managers fail to achieve changes in work practices.

PEOPLE: SUCCESSFULLY CHANGING MANAGEMENT PRACTICES & WORK PRACTICES

The common approach to managing change fails

Managers of businesses and processes must lead people to change work practices and attitudes in order to improve productivity, quality and reliability - to maximise margins and minimise risk. This is a universal challenge faced by managers and executives.

The combination of behaviours and attitudes (and to a lesser extent symbols) defines culture. Workplace culture including management culture is the greatest determinant of business performance.

The common approach to changing attitudes and behaviour is to simply provide training and communication alone. Many managers mistakenly believe that such effort aimed at changing attitudes will then lead to changes in work practices. Figure1.

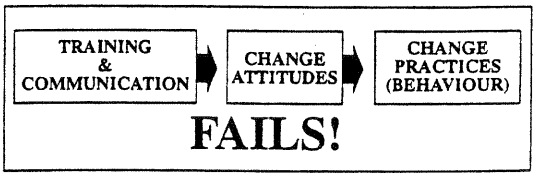


Figure 1 Common approach to managing change

This concept is not correct - and wastes valuable management time and effort. Instead, the reverse is true. ie, humans change attitudes to align with behaviours.

Consider how humans develop attitudes toward the world around them. People develop attitudes based on their personal experience and in particular based on aligning their attitudes to be consistent with what they actually do - their actions. Figure 2.

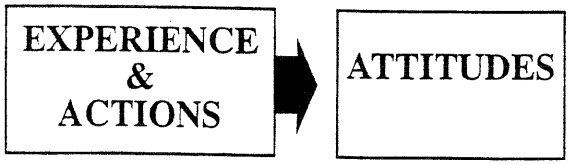


Figure 2 Human behaviour

Systems Drive Behaviour

Hence, the key to developing new attitudes is to provide managers and operators with new actions - new experience - by changing what they do. By changing people's work and associated actions. This is achieved simply by changing systems that drive behaviour. Figure 3.

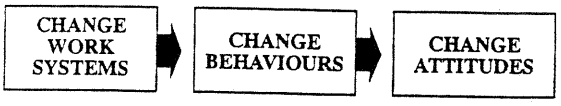


Figure 3 Successfully managing change

A system is defined as a combination of procedures, equipment, people, policies and/or values that drives people's behaviour. It may be formally recognised and documented or informal. ie, within an organisation, a system is anything that drives ways of doing things.

To change people's behaviour, managers must first change the systems in which people work.

Managers need to provide effective systems that drive the desired behaviour.

Dramatic changes in attitude will then follow. Mackay (1) provides a good, concise summary of this in current everyday terms. Brown (2) provides solid material to further describe the social behaviour of people at work.

Far from being the most difficult step, this is actually the simplest step - provided there is a basic operating philosophy to guide management. And provided management uses Measurement, Analysis and Reporting systems that drive teamwork and focus on learning about outputs and the processes that produced the outputs.

Modern Management Systems

Ten key systems for driving behaviour:

- performance measurement, analysis and reporting
- organisation structure
- management processes (planning, communicating)
- personal development and performance feedback
- remuneration
- accounting, budgeting and forecasting
- standards in core and service work processes
- systematic ongoing involvement of people and recognition of contributions
- methodology for improving processes
- overall plan for changing systems

Changing people's actions can be relatively simple. By far the greatest driver of human behaviour at work is the Measurement, Analysis and Reporting system. This establishes what is seen by managers to be important and displays the results of people's efforts. It defines the target toward which people work.

Unfortunately, many businesses use Measurement, Analysis and Reporting systems that mislead people and drive sub-optimal and even counterproductive behaviours particularly among managers.

Fortunately Measurement, Analysis and Reporting systems can be changed unilaterally, simply and easily to drive desired behaviours.

At the other extreme, changes to pay systems usually need considerable discussion and negotiation. Although such changes can sometimes be made quickly, more often they need to be made in stages. Regardless, even though remuneration systems are generally the second most powerful influence on behaviour few remuneration systems drive behaviours aligned with the business' goals. Indeed, many pay systems drive behaviours that are counterproductive.

Between these two extremes lies organisation structure. While managers have the prerogative to change structures unilaterally, developing and implementing the optimal structure often requires consultation which needs investment of management time and effort.

One North American client immediately lifted core process availability from 85% to 89%, simply by changing its organisation structure away from the traditional departmental structure to one based on processes. The client quickly started reaping additional major ongoing benefits in higher morale and pride as operators, mechanics and managers worked together. Additional benefits are also coming from increased ore recoveries estimated to be worth $2,000,000 annually. Furthermore, operating costs are lower.

Roberts (3) provides further examples of large sustained performance improvement.

Other systems for driving behaviour include:

- planning and design
- promotion
- safety management systems
- selection and preparation (recruiting)

Additional systems are listed by Roberts (3).

It is amazingly easy to change people's attitudes once the fundamentals are introduced correctly and behaviours are driven on-the-job with consistent, integrated systems.

As a mine manager, general manager and now as an external resource, the author has initiated and witnessed simple changes in management systems that have led to dramatic changes in management attitudes and significant increases in accountability.

The importance of correctly designing management and work systems to ensure effective culture change is detailed by Roberts (3).

(Leadership is also important. ie, strength of character, discipline, integrity, commitment, energy, vigour and spirit, together with effective communication, genuine respect and caring for people plus consistent management actions.)

The fundamental principle in leading change successfully is to not focus on attitudes. Instead, focus on behaviours - and change the systems.
The paper will now broadly examine the most powerful system for driving behaviour and building attitudes.

ACCURATELY IDENTIFYING WHAT TO CHANGE

By far the most powerful driver of behaviour and attitudes is the performance Measurement, Analysis and Reporting system. It determines what become people's targets and is far more powerful than pay systems.

Broadly, the two main purposes of measuring and analysing processes and businesses are:

- improving processes - identifying accurately what to change and assessing the effectiveness of changes
- understanding performance levels relative to targets (whether imposed by markets or internal budgets)

In this section the focus will be on improving processes.

Variation is a Law of Nature

There is variation in all dimensions, objects and tasks. No two people are identical. No two cars off the same assembly line will have exactly the same panel gaps even though from the same process. No individual or team will install roof bolts in identical times on every occasion. No two loads of ore will be trucked from face to crusher in exactly the same time. No two loads of ore will have exactly the same ore content when fed into the treatment plant. Variation occurs constantly in everything.

Hence, outputs from a process will vary even if the process remains unchanged. Such variation is known as natural variation. To react to each such variation in output by allocating resources or changing the process in reaction to each output point is obviously foolish and counterproductive. This is exactly the illogical behaviour that traditional measurement systems encourage.

Society's poor understanding of variation

Traditional Measurement, Analysis and Reporting systems lack understanding of variation. In such systems, work processes and their performance are assessed merely by comparing the latest output data point to a target/budget, or to the previous data point or to the average output. This reinforces poor understanding of variation - and leads to poor understanding of the process itself.

Decisions are commonly made as a reaction to the location of only the last data point.

Figure 4 shows a headline and graph from a supposedly reputable finance and business journal. The graph shows the "last data point" evidence used to justify an article implying the economy was slumping - at a time when the economy was clearly in full recovery. The incorrect analysis and conclusion reflected in the erroneous headline were based on comparing the last two data points - "O" and "N"! Yet the reader will quickly see the error by simply sighting the graph.

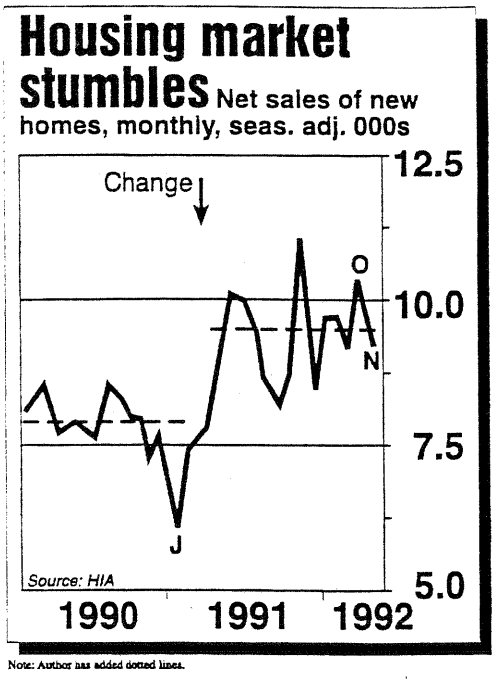


Figure 4 Poor understanding of variation

Traditional managerial and business analysis leads to many such errors. A quick glance at the graph shows there are two different "processes" for selling houses. The first portion of the run chart shows results during an economic recession while the second portion shows a dramatic and sustained recovery in sales. This shows a change in the process!

The two dashed lines added by the author highlight the change. Note that within both periods there is monthly variation due to natural variation.

Similarly, output (such as production, safety, quality and cost) will vary. Managers must not make incorrect conclusions from natural variation. Who would expect to sell exactly the same number of houses every month?

The headline's poor understanding of variation is representative of management systems guiding managers to operate businesses and manage processes by drawing conclusions based merely on the last output data point.

It is not just the use of graphs that is important. It is the graphical presentation combined with the analysis of data using an accurate understanding of variation.

Figure 5 identifies a change to an actual mining process. The change was missed by site operations managers and corporate executives. Using traditional analysis systems based on relatively few data points obscured the real improvement and prevented the changes from being identified and locked into place. Instead they were lost from the business!

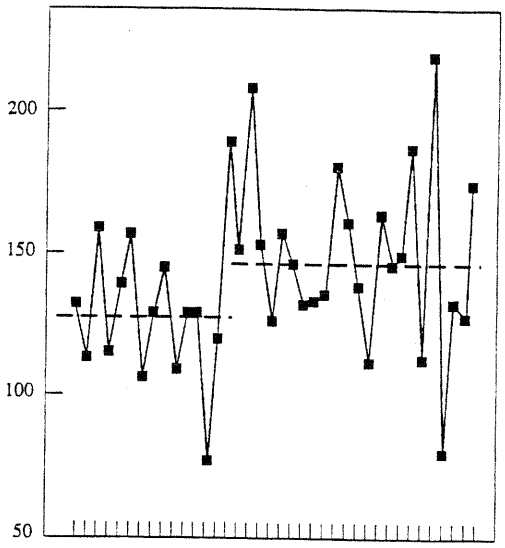


Figure 5 Identification of a process improvement

Simply graphing their existing data and eyeballing the run chart of process output data using an understanding of simple rules for analysing variation makes the improvement obvious.

How many such improvements in industry are not detected and therefore not locked into the process and thus lost? How many drops in performance are not detected and therefore not identified and locked out of the process and thus continue to suppress performance?

Many!

Budgets are not process improvement tools

Traditional measurement systems are characterised by reliance on comparison with budget and on the use of data in tables. Unfortunately such systems compare a single point result with the target. This does not produce understanding of process performance.

While variance analysis can sometimes identify that something needs to be done it cannot identify what to change in a process.

Many managers use budgets alone as process improvement tools. This leads not to focusing on root causes but to finger pointing, creative excuses and to suboptimal management decisions and behaviours. The irony is that this wastes resources, undermines management's authority and reduces discipline!

Budgets are important planning tools and scoreboards. They are not process improvement tools.

Contrast this with modern, accurate analysis using run charts and Pareto charts in the hands of managers who use the simple yet powerful principles for understanding variation to make accurate decisions!

Modern Measurement, Analysis and Reporting systems develop responsibility and accountability, focus people on solutions and drive united actions aimed at true continuous improvement of productivity.

Run charts and Pareto charts are just two of many simple yet solid graphical tools for unearthing precious knowledge immediately - and for accurately forecasting and improving process behaviour.

A better way – Run Charts

Leading businesses use run charts (Figure 5) to enable managers to accurately identify significant points indicating a process has changed. This is simply plotting and analysing process output data points in accordance with a handful of simple basic rules.

The human eyes are the world's most powerful and accurate statistical analysis tools. Eyeballing run charts in accordance with basic statistically sound and simple rules is recognised as the only way to accurately analyse data to obtain real knowledge of processes.

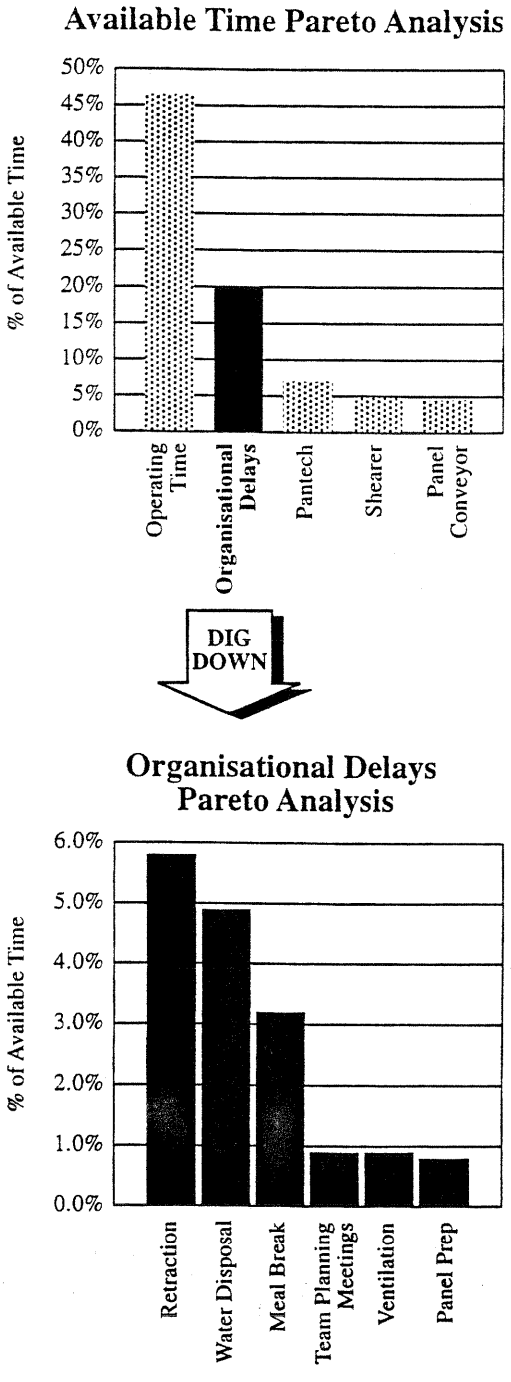
Once a change has been identified it is then possible to dig down to the root causes of the change. If the change is beneficial, it is captured by locking it into the process through standardisation. If the change is detrimental, it is locked out of the process. And so on for each change so that true continuous improvement occurs and is locked in.

Another solid analysis tool – Pareto Charts

When proactively making changes to production and commercial processes it is always best to first conduct sound analysis to accurately determine what to change.

Pareto charts (eg. Figure 6) provide the ideal analysis tool and can be coupled to existing data bases with minimal effort.

As stated by a client's manager after seeing the use of Pareto charts applied to analysis of production delays, **"from now on we won't be picking the jobs we want to do, we'll be doing the jobs that need to be done"!**



(Data has been truncated to maintain confidentiality and ensure brevity)

Figure 6 Pareto charts for systematic improvement

Cycle Time Charts

Figure 7 shows actual improvement of cycle times in development of an underground coal mine's roadways. At 20 days the first pillar development cycle was lengthy. Successive improvements reduced cycle time dramatically by standardising work methods. Once the process was stabilised and in tight control it was then possible to attack the sub-processes and productivity components. Modern analysis methods were being used at the mine to direct and monitor progress - to lead.

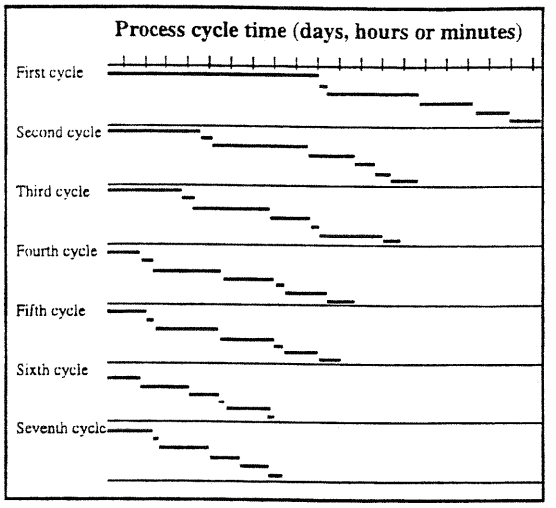


Figure 7 Cycle time chart

Contrast this with a commonly used measure of drivage rates in mines - metres/shift. This focuses on maximising individual shift performance and leads to sub-optimisation. Instead, in reality, drivage depends on the performance of all shifts and departments interacting around the clock.

Additional benefits of using cycle times occur in leading people to improve planning and to perform as many activities as possible simultaneously - in parallel. Cycle time charts move people's focus from just current tasks to the whole cycle. They communicate process improvement graphically and quickly. This builds work satisfaction and pride of achievement.

Cycle time charts also provide direct indication of waste - the longer the cycle time the greater the waste.

What's needed? Framework for effective analysis

Many organisations are wasting valuable management time in collecting unnecessary data and in neglecting analysis. Such businesses do not use simple, sound analysis to convert data to knowledge. They have lots of data yet lack real understanding of processes and of their business!

It is simple, easy and low in cost to build and use a suitable database or to modify most existing databases to provide solid analysis. The main prerequisite is to first establish an overall approach and framework to minimise the volume of data and maximise knowledge.

Remember, it's not measurement alone that matters. Such limited thinking drives counterproductive behaviour. And, as one client's manager said "traditional production (and business) stats don't tell me what to do – only what I did – and even that not adequately".

Instead, it's measurement, **sound analysis** and reporting that drives correct behaviours. In process monitoring and in safety and business performance improvement **the key is analysis**.

For additional information please refer to Wheeler (4 & 5), Deming (6) and Roberts (3).

Remember four facts:

- **Without data and sound analysis, you're just another opinion!**
- Sound Measurement, Analysis and Reporting systems develop people's pride in their work
- Enormous power is generated when everyone is focused on improving operating hours, hourly rates and labour utilisation (including safety)
- **Measurement, Analysis and Reporting systems are by far the most powerful drivers of behaviour and culture**

Take an holistic approach. Even though Measurement, Analysis and Reporting systems are by far the most powerful driver of behaviour, they become even more powerful when other systems are integrated. For example, planning systems, remuneration systems, communication systems, organisation structure, management processes, recognition systems and personal feedback and career development systems.

Measure and reward the behaviours you want.

Controlling variation is vital for understanding processes and identify opportunities. Controlling variation leads to putting the business and process knowledge to use in a disciplined, efficient and effective method for improving performance.

PROVEN METHODOLOGY FOR IMPROVING PRODUCTIVITY

First control processes, then improve

It is easy to tickle up performance temporarily with immediate changes. To sustain and then continually improve genuine safety performance needs more – managers need to first get tight control of processes.

The methodology for improving performance is based on these broad steps:

- define the process
- modify management systems to support the process and drive desired behaviours
- get control of the process, then,
- raise the level of performance by attacking the productivity components:
  - process operating hours (available time)
  - production rates per operating hour
  - resource allocation and utilisation

Then continually improve the process.

This broad outline forms the basis of the proven seven-step methodology for improving processes which unfortunately is beyond the scope of this paper.

The methodology's foundation is the fact that waste increases (and decreases) as variation increases (and decreases). This fundamental is now proven in commercial, production, marketing and administrative processes world-wide. It has been explained in theory by Taguchi (Deming, 6) and the relationship between variation and waste is detailed by Roberts (3).

It is particularly important in mining and agricultural processes which obviously deal with more highly variable input than do processes in manufacturing and service sectors.

Please note that the way to get control over processes is to reduce variation. This provides a double boost. Firstly it increases understanding and control of processes. Secondly as variation decreases there is reduced wastage of productive resources – so productivity increases.

An important first step in improving processes is to standardise the overall process and then standardise key components of the process. In doing this performance - productivity and safety - will improve.

The reason is simple. As variation decreases, the wastage of resources such as labour, ideas, time, money, capital and materials decreases! Processes with lower variation are also easier to manage and to improve. Planning is more effective and work is made easier - and thus safer and more productive!

Managers and their people have greater control over their work processes. People can then swing easily into improving the productivity components.

Mining examples highlighting the increase of wastage with variation are provided by Roberts (1995).

(There is also an internationally known methodology that applies at the micro-level of process improvement and enables systematic assessment, implementation and standardisation of new ideas and suggestions. This Plan-Do-Learn-Act (PDLA) loop is tied to the overall performance improvement methodology.)

Remember though that the control of variation and processes can only be achieved with accurate measurement and analysis of variation!

The benefits in accountability, safety, discipline, metreage, tonnage, throughput, yield, recovery, product purity/quality, total cost and unit cost in mines and mills go straight to the bottom line.

STRATEGIC ASPECTS OF PUTTING IT TO WORK

Solid overall plan

To ensure the development of all systems drives consistent behaviour, managers need to build and implement an overall plan for improving systems An example is provided in Figure 8. This requires and provides a strategic, holistic approach over the whole business.

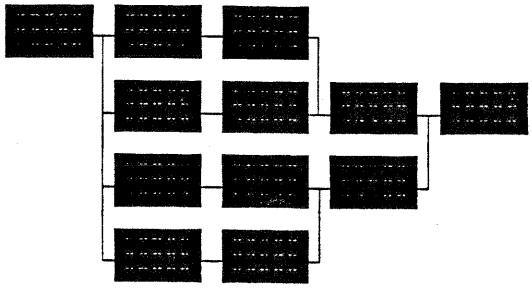


Figure 8 Strategic plan for successfully changing systems to drive desired behaviours

This also has benefits in showing each manager his/her responsibilities in modifying systems and displaying clearly the dependence of other

managers on his/her effort. Additionally in communicating change and instilling confidence in people it is essential that management demonstrates it knows where it is going – since people do not dislike change they dislike uncertainty. Significantly, a sound plan is extremely useful in reducing uncertainty.

Obviously, the most powerful driver of behaviour must be one of the first systems to be built - the performance Measurement, Analysis and Reporting system.

Practical Implementation

Ideally, implementation starts at "the top". Concepts are introduced and systems are built at senior corporate management level and then progressively through the organisation structure to the people in the core production, commercial, administration and marketing processes.

Where there is need for immediate performance improvements it may be necessary in practice to first build and implement basic systems at the management level which makes daily operational decisions. In such instances implementation should then proceed quickly up and down the organisation. Figure 9.

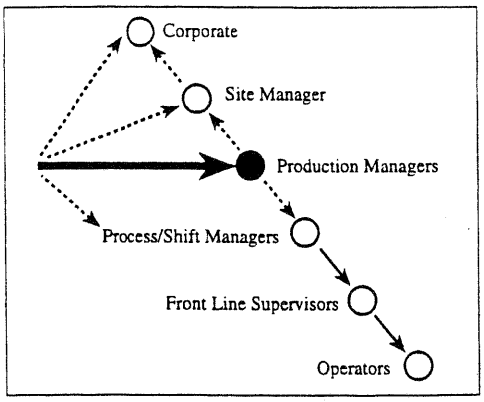


Figure 9 Implementation sequence for rapid improvements

Where senior management is not committed to the way of working, this second implementation sequence has higher risk than with starting at the top.

Thus, the starting point depends on balancing the client management's immediate and long-term needs, skills and commitment.

Never commence implementation with the operators. Unfortunately this is where many attempts to implement the principles start - and therefore fail. While it's easy to start at the face and "tickle-up" performance, the improvements will not be sustained.

For higher performance to be sustained, appropriate supporting management systems must be in place.

Managers who try to start implementation at the operator level often do so because they mistakenly think the concepts are merely a human resources initiative and a bag of process improvement tools for operators. Such managers fail to fully understand the principles.

Implementation traps are detailed by Roberts (3).

In improving businesses there is rarely a need for extensive training or lengthy, expensive strategic analysis. Most organisations already contain the necessary talent. It simply needs to be harnessed and united in a common way of working under appropriate and consistent modern management systems.

During execution of the plan it is important that in addition to understanding and using the overall steps, managers and operators are left with tools and systems for continuing to improve productivity themselves as part of their ongoing daily work.

Above all, this is a strategic initiative. It is most leveraging at senior corporate and site management levels.

SUMMARY AND CONCLUSIONS

The proven principles broadly discussed in this paper form a complete way of working, a foundation for best practice management systems, a methodology for improving processes and an integrated group of productivity improvement tools for continually improving processes and results.

This paper has focused on the Measurement, Analysis and Reporting systems and on the importance of systems in general for driving behaviours and attitudes.

Firstly remember, to improve results, first improve processes.

Secondly, people using traditional measurement systems fail to recognise natural variation and cannot correctly analyse business processes. This prevents full understanding of work processes. Core problems are often not identified and thus the biggest opportunities for improvement are missed. Instead of fixing core problems, people react to the last data point and chase symptoms. This wastes resources and drives sub-optimal and even counterproductive behaviour.

A proven alternative exists. The use of simple

statistically sound graphical analysis tools provides real knowledge about work processes and waste. When people are armed with real knowledge they are effective in identifying and killing waste using a proven methodology for maximising productivity.

Do your business' current measurement, analysis and reporting systems focus managers on allocating resources in reaction to the last data point? Or, do systems encourage real understanding of work processes?

Thirdly, in changing work practices, don't focus on attitudes. Instead, focus on behaviours. Build systems that drive the desired behaviours - which will then develop the desired attitudes.

Consider whether current Measurement, Analysis and Reporting systems focus people on avoiding blame and providing excuses? Or do they focus people on accepting responsibility and developing real accountability for improving business performance?

The Measurement, Analysis and Reporting system is by far the most powerful driver of behaviour aligned with any organisation's business goals.

Pause and consider the formal and informal systems that currently drive people's way of doing things. What do current systems tell people? What behaviours do current systems foster in your managers and their people?

Adopting this consistent way of working and using its proven methodology for process improvement will improve management and workplace cultures. It will optimise business processes to maximise safety productivity, margins and return on investment.

World best practice systems and genuine safety - isn't that what you want?

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