

A New American TPM: Leadership requirements for breakthrough change

James D. Griffith, Manufacturing Mgr.
BP Amoco Chemicals, Green Lake TX

Donovan J. Kuenzli, Refinery General
Manager, Clark Oil, Port Arthur TX

Paul A. Monus, Senior Project Manager
BP Amoco Chemicals, Lima OH

Summary of the paper:

Reliability improvement efforts began in earnest at BP's Lima Ohio Oil Refinery in 1995 and achieved stunning results by 1997: value additions of \$0.77/bbl that have been sustained (worth \$43million per year), with improved safety and environmental performance.

In addition the decision to close the refinery was reversed at the last minute when a buyer (Clark Oil USA) was found, generating \$175 million value for BP, and also averting significant costs for closure and environmental remediation.

Clark purchased the refinery in large measure because the plant workers and managers had maintained the refinery in excellent condition during the two year period after the closure had been announced by BP, and had continued a relentless pursuit of improvements and innovation.

This paper looks at the **leadership aspects** that enabled this sort of achievement, particularly the roles of executive authorities, line managers, and network leaders. We think the approach Lima followed can be replicated in other places, but only if all aspects of the change process are properly understood, and only if all the needed leadership roles are skillfully applied.

The action team approach which depends on workers accessing untapped capacity in themselves is a new approach for generating TPM levels of performance. A dialogue between the authors (who represent the three types of leadership) will be part of the presentation.

Introduction

Our presentations to NPRA in 1998 and 1999 describe both the results and the process we used to create breakthrough change at the 175 mbd refinery located in Lima, Ohio, formerly owned by BP Oil. In August 1998 the was purchased by Clark Oil USA.

In this paper we hope to cover new ground, rather than rehashing the same things described in these earlier papers.

This is a disadvantage for the new reader who has not seen our earlier papers in that we build on some things we've said earlier; for people new to our work, please see the abridged summaries of these papers in the appendix, which also contain some of the results achieved via this change effort.

Please contact the presenters or NPRA if you want reprints of the earlier papers.

In this year's paper we want to focus on *leadership of the change effort*, as this seems to us to be the most significant thing we have not yet described in the earlier papers. So, we'll now press on.

Most change initiatives fail

Peter Senge, in his new book The Dance of Change talks about failed change efforts:

"Two independent studies in the early 1990's, one published by Arthur D. Little and one by McKinsey and Co., found that out of the hundreds of corporate Total Quality Management (TQM) programs, about two thirds grind to a halt because of their failure to produce hoped for results. Reengineering has fared no better; a number of articles, including some by reengineering's founders, place the failure rate at about 70 percent.

Even without knowing the statistics, most of us know firsthand that change programs fail. We've all seen enough "flavor of the month" programs "rolled out" from top management to last a lifetime. We know the cynicism they engender. We have watched ourselves and

others “salute the flag” and then say privately, “here we go again” with “another fine program,” while thinking “this will never work.”

It is important to note that failure to sustain significant change recurs again and again despite significant resources committed to the change effort (many are bankrolled by top management). This happens even with talented people leading the program, and high stakes for the business.

Our core premise is that the sources of these problems cannot be remedied by more expert advice, better consultants, or more committed managers. **The sources lie in our most basic ways of thinking. If these basic ways of thinking do not change, any new “input” will end up producing unproductive types of actions.**¹

Lima Refinery is an exception to this pattern—significant transformational change has been sustained

We think that Lima Refinery is a “case study” in transformational change. To beat the odds of failure we had to change “our most basic ways of thinking.” To do this successfully required different kinds of leadership.

Three sources of leadership emerge:

- (1) from **authorities** (executive leaders who commit resources, decide the overall business context, and worry about financial results)
- (2) from **line leaders** (workers and operational leaders / managers who must get the daily work done)
- (3) from **network leaders** who research and apply ideas.

Senge’s point about needing to change “our most basic ways of thinking” creates some huge questions:

- (1) How do we as individuals change how we think, especially our most deeply held beliefs and paradigms?

¹ Peter M. Senge, et al The Dance of Change—The challenges of sustaining momentum in a learning organization, Currency Doubleday, pp. 5-6.

- (2) How to change the collective thinking and paradigms in a group of people?
- (3) How to change our thinking about leadership? {Our paradigms and habits of behavior are deeply inset, especially when it comes to what we expect and look for in terms of leadership}

Workers tend to look to bosses for “the answers”, for direction and for risk taking, and assume they have less authority and ability than they typically have—while at the same time complaining about the lack of empowerment they are given. This results in untapped capacity (in workers) that few organizations can access.

Authorities often do not demonstrate receptivity to new ideas, especially new ideas that are threatening to their personal style. This can result in failure to adopt new technology, failure to create the right environment for innovation and empowerment, and additional stress and workload for line leaders and workers.

Alignment of thinking and action

If adopting new patterns of thinking and behavior is a key requirement for successful transformational change, as Senge notes, another key issue is how to maintain alignment of thinking and action in everyone as changes occur. For many people changes remain in a form that are still too abstract to be actionable; they want to know:

- 1) “what can I do tomorrow morning?”
- 2) “what do I change?”
- 3) “how do I change?”
- 4) “how do I get those other guys to change too? {the assumption is that the “other guys” are a key part of the problem, much more than my part}

We think that building alignment of motivation and action between workers and authorities can occur through the means of an idea. If authorities can see that workers are sincere, and that the idea that workers

are pursuing fits their view of the overall needs of the business, they will support the workers and line leaders.

In this way, the “cause” that workers are pursuing (in our case defect elimination and a precision plant) become something that workers and authorities can get excited about and support, independent of each other.

Getting both authority and worker to have the same attitude about “the cause” is key, because unless they develop the same attitude towards it, the strategy we pursued will not work.

JG Bennett wrote about this in his works on “Systematics of Organization.” The following quotes are fragments that shed some insight on this:

“5.2.3.1 The authority is the unifying factor that enables the worker to be effective. The unity of the organization is lost if the worker group takes decisions into its own hand.”

5.2.3.2 The strategy requires loyalty to authority as well as devotion to the cause.

5.2.4.1 One must believe in the cause and be confident that it is worth serving. A subordinate may approach his superior with suggestions that in other circumstances might seem impertinent, providing he is confident that his superior has the same objective.

5.2.6 The role of authority in this strategy is to recognize the sincerity of the worker and ensure that the cause to be served is realistic and acceptable, and only then commit full resources to the operation.”²

We will be talking about these concepts later in the paper, in more detail.

The overview of our approach has been to use the Manufacturing Game™ to cause everyone (workers and authorities) to

² JG Bennett, Relationships in Organization, UniS: Journal for Discovering Universal Qualities vol. 1, #3, pp. 22-23.

experience the end state of a TPM (Total Productive Manufacturing) effort--a precision plant. We then create a dialogue about what it will take to create this type of “precision plant” as *our* asset. Design of who attends this workshop with whom is important. And a key part of the approach is to invite workers to access their own untapped capacity during the workshop by participating in an action team on real problems, to eliminate some defects.

Some actions teams achieve huge early success; these sorts of breakthrough results—achieved just by using what was always within the action teams own capacity to get things done--attract the attention of authorities. Then, it is up to workers and authorities to co create the right environment for building a new and sustainable culture of breakthrough thinking and improvement, to sustain a “bootstrap process” of innovation and performance improvement.

We think the process of building alignment between workers and authorities is a type of “coalescence” that occurs when the right idea is presented and acted on in the right way by both.

Learning how to create this sort of coalescence is the key job description of the three types of champions (representing authority, worker, and idea) that we will describe later in this paper.

Coalescence can occur “naturally”, when external circumstances demand it (such as a country going to war, or repairing and restarting a plant after a major incident), but this often fades and is not sustained—old patterns of thought and action recur as soon as external circumstances go back to more normal.

Sustaining the “coalescence” between worker, idea, and authority is the challenge.

If this state can be sustained, an almost unlimited source of innovation and improvement will come into view and become accessible.

This state of coalescence feels almost “magical”—this is because it is so untypical from our normal experience (more typical experience seems to be misalignment, wrong ideas, workers not taking authority, authorities not empowering etc.).

Why was Lima Refinery Successful?

With this as prologue, we’d now like to update what we shared in our NPRA presentations of 1997 and 1998 (*refer to these prior papers, as this paper seeks to add to and extend the story in these*).

BP’s Lima Oil refinery achieved stunning results via a program we called “Proactive Manufacturing.” These changes have been sustained for more than four years now, and people working in this plant describe the change effort as the “flavor of the four years.”

But, other assets in BP and other companies have also used similar “inputs” without achieving these sorts of breakthrough results. Why haven’t the same “inputs” applied to these other assets been as successful?

We are not saying we have any sort of final understanding about this; rather we hope to open some new conversation, ask ourselves some new questions, and discover more deeply what really was going on in our experience vs. what happened elsewhere. This is the spirit of discovering, and learning, which requires that we must come to these questions from a framework of “not knowing.”

Without saying “we have the answer” the sense we have about the success of Lima vs. other assets using the Manufacturing Game™ is we had evidence of genuine

leadership emerging from all three elements: network leadership, executive leadership, and line / operational leadership. The inputs from the three types of leaders were aligned and sustained over time--there was “coalescence” between authority, worker, and idea.

One of the key aspects of coalescence is that idea becomes the key driver of change, and creates and sustains the alignment between line leaders and authorities.

Mindsets and behaviors

Our first and most important point is that success happened mostly through changes in the **thinking and behavior of the people** of the asset. We individually and then collectively adopted new paradigms and behaviors, to face risk differently, to collaborate instead of compete, and to share learning and rewards differently. We built on the strong sense of community that was already present, and found new ways to do our work. We found “our answer.”

Unfortunately, this approach may not work for other assets, verbatim. There is no “right answer” for other places; rather while the guiding principles should work the same, they will have to be adapted for any new / different place trying to use the Manufacturing Game™ and action team process.

But a key point is that mindsets and behaviors (which reinforce reactive results) have to change to more effective mindsets and behaviors (to get TPM results).

It is a little disheartening not to have a single “right answer,” but we think each new site that tries to approach transformational change in the way we did (using the same sorts of tools of the Learning Organization—like the Manufacturing Game™) will have to

reinvent the steps and approach suitable to their own situation.

This is true for a couple of reasons:

- 1) the business context is different in a new site, and
- 2) the people in the asset are different, holding different mental models about the world, different priorities and values, and different levels of energy and capacity for change.

Figure 1 shows a framework from **Action Design** (a consulting company in Boston we have used).

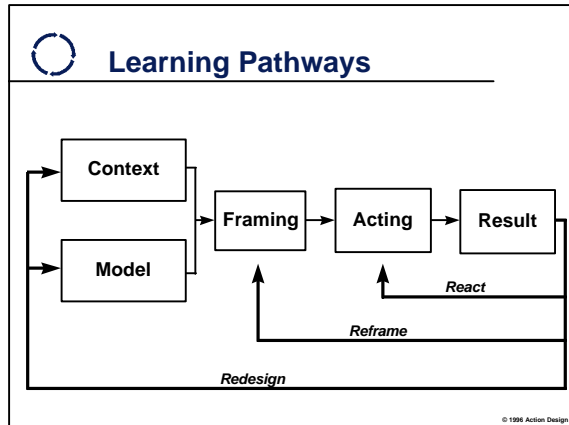


Figure 1

Figure 1 shows that the results we get are a consequence of the actions that we take (or don't take). This seems like a simple point but it is quite profound. And the actions we take are the result of our thinking, and how we frame situations. We frame situations based on our stock of knowledge about the world (our "model") and the specifics of "this situation" and its context.

Frames are really important. If a worker frames a situation such that "I cannot do anything" to affect improvement, and feels disempowered, then this feeling, this sort of thinking, will tend to lead towards actions which will provide confirmation of this belief. Morale may suffer, and the ownership and responsibility for designing

and taking actions leading to improved results shifts to just a few people (mostly in management) who become overloaded with work.

Another frame is that we can all do something, via changing how we approach all the *small* tasks we do each day; these add up, and matter. Another frame might also suggest that it is up to us to create the future that we truly want--no one else can do this for us. This is a different from the frame that suggests "the top must do it," and is a much more empowering perspective, and one that leads to different actions and results.

Learning how to bring our spirit, our full talent, our passion, to work, so that we can contribute towards creating the future we truly want, is a new skill for most of us.

It is the shift in our frame from having a job, to having a vocation; from being an employee to being part of a community.

Do we seek to create the future we want, everyday, at work?

Job = Vocation?

For many people, their job is not their vocation. They do not feel able to choose their destiny. They may leave their spirit, their heart, and their passion, at home.

Figure 2

Just as individuals have a frame for each situation, groups can acquire a shared set of assumptions, shared mindsets that affect how action is taken and results are achieved.

An "environment" for "bottoms up" change

We now want explore the leadership challenges and activities we pursued to create the proper “environment” for challenging our existing mindsets, frames, paradigms, whatever you want to call these--shifting our thinking and behavior in the refinery.

If our premise, that creating the right leadership (from authority, worker, idea) enables the right environment for a “bottoms up change” process to develop and survive, then we must examine our frames about leadership.

Examining our thinking is not a normal activity for most of us. We are too busy “doing” to stop the action and reflect on results we are getting, and then to notice the connection to how we are thinking. If we can do this, it becomes possible to notice the impact of our thinking and beliefs on what actions we choose to take. Then we might start to design new ways of working, new actions, based on new decision rules, and new thinking.

We need to do this, but not from a top down “the authority thinks and everyone else just follows their instructions” style. Instead, everyone, including workers, need to take responsibility for reflecting on how we are thinking and impacting each other.

We think this approach to changing our frames, our thinking, by

- (1) changing the work we do,
- (2) by launching lots of self organizing teams,
- (3) by focusing on learning and dialogue,
- (4) by trying to tap untapped capacity in workers,

is pretty new . At least having big success with this approach seems uncommon.

Here some of the features of what we did:

1) Self organizing action teams

Instead of pursuing the traditional approach to reliability improvement, we launched self

organizing “action teams”. Even though 50% of these teams died without accomplishing their work purpose, we achieved huge results. Failure of the teams was not punished; instead we sought to learn and improve next time.

These teams were carefully designed, motivated, and educated (via the Manufacturing Game™ workshop) and then launched. Success or failure of the teams was up to them.

We had to learn some new skills and behaviors, such as how to design these teams, and how to let go of control and let them succeed, or fail, on their own.

Rather than management driving the change, we sought to inspire the workers, *to take authority* via pursuit of their own good ideas, and then find their own capacity for implementation. This created real ownership, meaningful work and thus internal motivation.

Trusting workers was a new skill and behavior for many managers and supervisors. Feeling the pressure and doing something myself was something new for many workers.

Letting go of control gives a very different feeling than the “meticulous obedience to the boss” approach to TPM in Japan. Obviously we’d like to have had higher than 50% yield from our efforts, but we prioritized building internal capacity for taking action over the results themselves, with the hope that as people failed and learned, they would find new ways to succeed next time.

2) Quick results

The quick results from this approach were a surprise. We found that large value can be created in a short time, with minimal capital investment, merely by liberating the good

ideas workers had, once the environment for implementing these ideas was created.

Later in the paper we recap a few results; see our other papers for more specifics.

Another new behavior was demonstrating more cross functional awareness, understanding, empathy, and cooperation. These are “systems thinking” capacities, that we built up over time in everyone.

The new paradigm *in use* was “instead of building my own kingdom, we should all work together for the good of the whole.”

3) New organizational infrastructure

New structures, such as the CI (Continuous Improvement) Forum, emerged from trying to change the work. These changes were much more driven by the work, and were not from team training, or personal development inputs.

We did not stress teamwork, nor planning, yet real teamwork and much improved planning resulted from being able to restructure the work, from a reactive to more of a proactive approach.

A conscious synthesis of tools and methods from TQM (total quality management) and the Learning Organization was used to support these efforts, including work on vision, productive conversation, systems thinking, and dialogue.

4) New capacity for dialogue

A key part of this new environment was providing many types of interactions between groups and cultures that formerly had limited interaction.

Workers and authorities met for dialogue. Cross functional communication improved via creation of area teams. Cross organizational understanding and communication (asset to asset within the

refinery, and we to our suppliers and customers) also improved.

A New American TPM

A process for achieving manufacturing excellence by engaging the whole workforce



n The features of the action team approach: how it is different from the traditional approach

- motivation and capacity of people
- challenges and roles of line leaders

n Financial results, much faster than the traditional approach to reliability improvement

- Large value add can be realized (\$0.77/bbl) in a short time
- Challenges and roles of executive authority

n Three cultures / leaders that must work together

- The “network leader”--pursuing ideas and creating understanding in others
- Creating receptivity in executive authorities; risk taking, creating space

n Replicating the results of Lima Refinery: a dialogue between Don Kuenzli, Jim Griffith, and Paul Monus

Figure 3

The action team approach

The action team approach has very different *leadership requirements* vs. the traditional approach.

We will first focus on the role of the line leader, then the executive authority, and lastly the network leader that this approach requires.

Achieving “coalescence” between these three types of leadership seems to be important to creating alignment of motivation and action in the larger organization.

Line leaders often are pressed by executive authorities to improve performance. Often they are coerced into implementing programs for improvement that they don’t fully endorse or understand.

Benchmarking is one source of ideas that seems to create demand for change. A delegation visits a plant or company reputed to be higher performing and notices some feature, such as planned maintenance, as a key aspect of the higher performance. This is then seized upon as a “silver bullet” that will create the needed results, and “rolled out” in the organization.

The literature on reliability improvement clearly shows the benefits of planned maintenance. Visiting a plant that has achieved the planned domain, such as Alumax (an aluminum company in South Carolina) can provide motivation and enthusiasm for planned maintenance. But what is required to sustain the planned domain may not be clear during the visit or analysis.

One “invisible” factor is how people in the visited organization think and interact. To sustain planned maintenance, for example, reactive thinking and decision rules must be replaced by thinking and decision rules supporting the planned domain. And everyone must support the thinking by their daily actions and behaviors.

To change to a new (better) performance domain, one must change the thinking and behavior of everyone in the asset. Anyone (authority or worker) can start a reinforcing backslide to lower performance, if they are not truly able to think and behave according to the new paradigms.

DuPont showed that these “pieces” are not separate at all, but must be approached in an integrated manner, all at once, and sustained, to achieve the benefits of planned maintenance. This takes a new way of thinking.

Old paradigms, such as measuring “wrench time” for mechanics, or a mis-impression about whether a planned or inspector is “busy enough” finding defects, must be replaced with new paradigms.

We must start valuing the ability to create plannable work, work to understand equipment conditions, and investigate all failure events to learn root causes. Then we must design the root causes of failures out of the equipment and procedures.

Even if a company truly dedicates itself to creating improved performance via planned maintenance, it still typically takes 2 to 4 years, significant resources, and shifting the thinking and behaviors of everyone.

Is there a higher leverage approach?

What is often missed in the effort to improve, via planned maintenance, is that there may be a higher leverage approach than pursuit of the planned domain.

TPM levels of performance are clearly better than what can be achieved via planned maintenance, based on the benchmark data. The DuPont benchmarking data shows 25% lower maintenance costs vs. the reactive domain, and 10% better than planned domain. Why is this?

What is often missed in pursuit of the planned domain is that the focus is on improving the efficiency of maintenance, rather than the elimination of maintenance.

Figure 5 shows that to achieve the TPM domain, **eliminating work** is required.

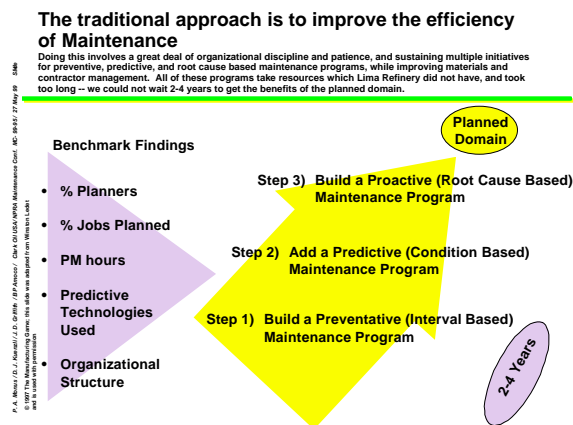


Figure 4

Figure 4 shows what is typically required to achieve planned maintenance. The steps to move from reactive to planned often are done in sequence, or separately, without understanding of the need to align and sustain all efforts, together, over the longer haul.

Lima Refinery chose to focus on eliminating work, rather than improving efficiency of maintenance

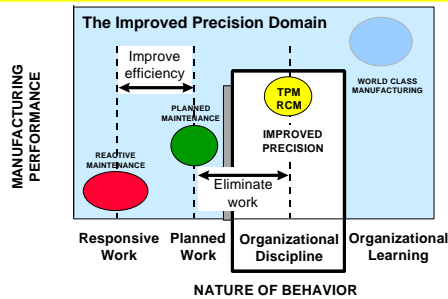


Figure 5

Can we believe that 90% of the work we do today could “just disappear”? That we could find the sources of the problems and eliminate them forever? If not, our thinking is limiting us.

DuPont reports³ that people who were most instrumental in helping to move from the reactive domain to the planned domain became an obstacle to going beyond this level to the next step, TPM. They thought the goal was planned maintenance.

The goal should be to not spend *any* resources on maintenance. Getting beyond the paradigm which says “everything has to break” eventually is a key feature of this resistance to moving beyond planned maintenance.

The difference between eliminating work and improving how we do work is a shift in our “most basic ways of thinking.”

Given the luxury of time (2-4 years) and resources, pursuit of the planned domain via the traditional approach to reliability improvement pays off. See figure 6.

³ Personal conversations with Winston Ledet, formerly with DuPont’s CMLT, Corporate Maintenance Leadership Team

Traditional vs. action team approach

Lima Refinery achieved TPM-like performance levels in much less time, and with no increased resource levels

We did it by eliminating the reactive, repetitive, breakdown work, thus freeing resources to go after more problems, thus “bootstrapping” our way in a “pay as you go” sort of approach.

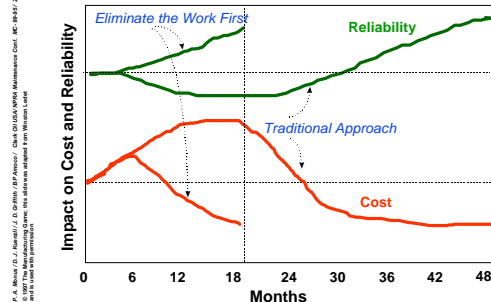


Figure 6

A disadvantage however, and a reason that backsliding from planned maintenance seems to often occur is that there is a “worse before better” time, where organizational patience and resolve are tested. To succeed, you must stay the course long enough to get the benefits of planned maintenance.

Lima Refinery didn’t have this luxury of time or the ability to hire extra resources to go after the planned domain via the traditional approach. We need much more rapid improvement.

Why is the action team approach better?

The reason the action team approach works so well (if you can create the right environment for it to work at all) is that it uses a nice reinforcing process, a virtuous circle.

The goal is to create time and resources, which can then be reinvested towards eliminating other defects, liberating even more time and resources.

See the causal loop diagram, in figure 7, on creating time for improvement.

Time for improvement work

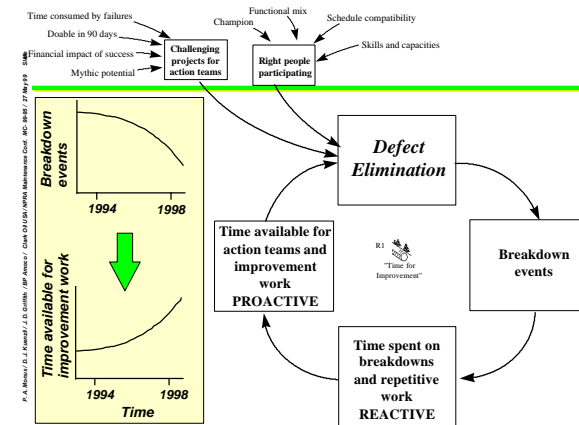


Figure 7

The key to this is starting an ongoing defect elimination process that reduces breakdown events, thereby liberating time for improvement work.

To start this, action teams need two essential components: challenging projects that will create a bottom line result in a short time, and the right people participating on the team to create these results.

Part of getting this going in the virtuous circle shown in figure 7 is the willingness of people to work cross functionally on the deeper systemic issues that constrain or hide more fundamental solutions to plant problems.

Figure 8 shows the tensions of pursuing the short term “quick fix” vs. longer term solutions. Often the quick fix is to find a heroic individual who rescues from crisis, “the fireman” who can be depended on to solve the problem today, or at least deal with the symptoms.

One powerful force that sustains a culture of reactivity is reward and recognition for heroic individuals.

But, the unintended and undesired side effects for rewarding the hero is that it

tends to demotivate teamwork in the larger system.

Mental models of the heroic culture

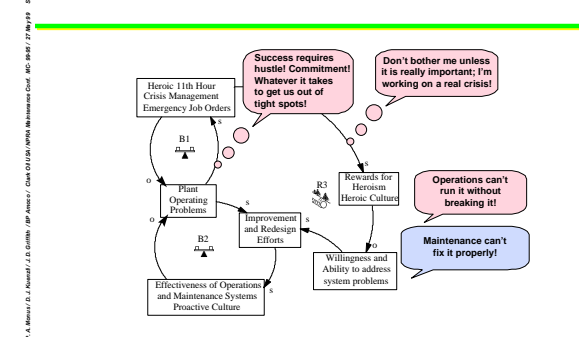


Figure 8

The dilemma managers find themselves in is that they really should reward the people who put out the extra effort and do the firefighting efforts and crisis managing.

Operations people tend to think “maintenance can’t fix it properly” and blame them, and maintenance people tend to think “operations can’t run it properly” and blame them.

Rewarding the heroic maintenance person for fixing it fast tends to leave defects in the equipment that contribute to the next failure event.

Rewarding the operations person for running it hard and starting up quick tend towards loss of operational discipline needed to avoid inflow of new defects from operations.

Behaviors and thinking become self reinforcing and no one has time to work on improvement or the deeper fundamental problems.

In the traditional, functional, approach to reliability improvement “maintenance is king” and drives the process, with a focus on three sources of defects: eliminate collateral damage from failure events (don’t run to failure), improve maintenance

workmanship, and get the maintenance materials / stores aspects right.

To succeed one must do all of the key aspects (inspection, condition monitoring, root cause evaluation, contractor and supplier management, planned and preventive maintenance, etc.) and keep on doing them in a coordinated way. This implies a need for control and discipline.

Often the operations and engineering people in the plant are left out of these efforts, as there is little they can directly do to contribute.

Don't focus on short term cost; the focus should be value

One key focus on the traditional approach is cost reduction. There are many ways to reduce cost, not all of which are good for operations or the business.

If operations is not a full partner, often the inflow of new defects continues as it was, leading to higher costs, and conflict with maintenance.

The action team approach stresses the whole, and focuses on value, including the overall value of uptime.

Thinking in terms of value, and going beyond just maintenance cost, is a key shift vs. the traditional approach.

The difference we saw is that operations and design people contributed much more to the defect elimination effort (via action teams) once the paradigm of maximizing value from the business took hold.

Operations will be a lot more willing to participate once they are sure maintenance is doing something that will result in higher uptime, and especially if this doesn't cause them to exceed budget (over a year) or add resources.

A New American TPM

We think the action team approach we followed is a new way to create TPM levels of performance, that works in American culture

n The traditional approach for planned domain

- functional in focus
- maintenance led
- high control, depends on coordination of activities
- eliminate 3 sources of defects
- need extra resources, performance worse before better
- 2-4 years to achieve planned domain

n The action team approach of "eliminate the work"

- cross-functional in focus
- business led
- low control; trust the action teams
- eliminate all five sources of defects
- stay within existing budgets
- results within 90 days, transformation in 18 months

Figure 9

Cross functional collaboration and cooperation is a key feature of the action team approach. A key leadership requirement is to make this an attractive thing, and to design the daily organizational interactions in such a way that the "good of the whole" becomes prominent and in everyone's thinking.

Design of the action teams is key

Designing the environment for self organizing teams to flourish is an essential role for the line leader / manager. Since the action team approach depends on the passion and composition of team members to work, getting the mix of people and the right projects is a key activity requiring knowledge of both the issues / opportunities in the plant that an action team could handle and also the people who will be on the team.

Line leaders usually know where the problems are, and they know the people who do the work. The task of "cat herding" is to match these in a way that is compatible with schedule (who can actually work on a problem together), skills, passion for the topic, and other demands for energy and time on the people.

It is the "art of the possible"; good cat herding does not focus on the highest cost item, or the biggest problem—instead we

tended to pick problems based on number of failure events, time consumed by the failures, and passion levels for the problem in people. Better to do something about a smaller problem than nothing about a big problem.

A key role for line leaders is to implement ideas for practical results

Line leaders have a focus on “getting results today.” Enrolling them so they can see and believe that these chaotic-feeling action teams, many of which fail, can actually produce transformation is a key activity for the network leader to assist with.

The clarity of the idea and the more directly observable the data about the problem, the better. A good description of the problem enables a good design for the team. The network leader must work with line leaders in helping design action team topics and mix of people so the idea of defect elimination becomes more clear to everyone, and that we stay in a learning mode (not a performance mode).

It is just as important for teams to build their own capacity as it is to get “results.” Teams that fail should be analyzed to see why they didn’t succeed, and so design of the next try can be more successful.

Line leaders are energy managers

Line leaders have to fight off or deal with many initiatives, some of which are well intentioned but not appropriate, from executive authorities.

The line leader thus has a role as “energy manager” to regulate what gets worked on and when, to allocate the limited budget of people’s time and energy in the asset.

Line leaders also act as a filter, to limit what is asked of people to be what they can handle. At times they may need to appeal to executive authorities to acquire extra

resources or training for action teams to succeed.

Line leaders serve as “translators” of ideas to workers. This means taking an abstract principle, like “Don’t Just Fix It, Improve It” and being able to discern what this means for pump 202 during a decision time at midnight. Coaching and mentoring others to raise understanding about the practical application of ideas is another key role.

Lastly, line leaders work with network leaders to clarify, and simplify ideas so they can be implemented properly by workers.

Both network leaders and executive authorities tend to be further removed from the daily demands of the work, and may not be sensitive to current realities as well as line leaders.

The role of the line manager in driving Proactive Manufacturing

- n **Generate the right compliment of workers to achieve the results required to implement the ideas**
 - cat herding; mixing people and projects to design action teams
 - energy management
- n **Knowing the people, their capacity, and what they are concerned about--their passion and hot buttons**
 - eliminate constraints to success by knowing your people
 - use passion as a guide, not cost
- n **Work with network leaders to simplify and clarify the ideas so everyone can understand them and buy in**
 - celebrate success
 - reinforce what is going right

Figure 10

Line leaders need to raise questions and concerns for dialogue and debate with network leaders and executive authorities. They are closer to the “theory in use” and can articulate policy and guiding ideas workers are going by, so that if changes in decision rules are needed to reinforce proactivity these can be made clear.

Line leaders must reinforce what is going right, on a daily basis. They are the link between executive authority and the

workers, and between idea (network leadership) and workers.

Workers seem to be quite sensitive to the wishes of executive authority, even if it is just to resist the changes. Line leaders must play an ombudsman role, demonstrate new behaviors, celebrate success, and create enthusiasm for the journey to proactivity.

Sometimes a visual symbol is the most powerful way to do this. The bug picture mentioned in our prior papers continues to be a key communication device about the journey. See figure 11.

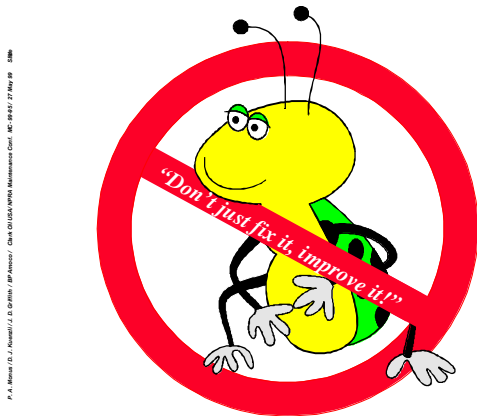


Figure 11

We've had a lot of debate about how the bug should look. Line leaders had a role in this debate by noticing that if the bug were ugly, like a cockroach, we'd be motivated to kill it. Our poster child is not that ugly, he kind of looks like a friendly sort. Just as we typically don't kill a ladybug that lands on our finger, the bug in our picture doesn't evoke a negative reaction. We kind of like him; he is so familiar.

We put the slash across and used the "Don't Just Fix It, Improve It" slogan to indicate that we want to kill even the small defects, the ones we might not be immediately pressured into removing.

Lots of people making small changes, removing small defects, adds up to big improvements. This is the essence of how the "eliminate the work" of figure 6 creates the dramatic improvement vs. the traditional approach.

Thinking small, and designing action teams to be for things a small team can actually do in only 90 days without extra resources, this is a new skill.

Network leaders and executive authorities have much less daily contact with these "small bugs" in the asset. Knowing which projects to pursue, and building credibility and capacity for taking these small risks in the daily work is a key role for workers and line leaders.

To succeed, workers must pursue these improvement opportunities, but get the daily work done as well.

Simple rules in use

Line managers don't typically have time or the desire to go deeply into theory about this journey to higher performance. Instead they tend to respond better to a contrast in "simple rules in use" that can be used to test what we do in specific circumstances.

See figure 12 for our list of "simple rules" that became "theory in use" in all the daily decisions and actions we took in the plant.

The first three reinforce proactivity, the bottom three reinforce reactive behavior and fire fighting / crisis management.

Shifting mindsets and behaviors

These new decision rules will create proactivity, but they must be understood and promoted in every decision, every day, by everyone

- n Don't just fix it, improve it
 - n Focus on value not cost
 - n Maintain and enhance your license to operate and reputation
-
- n The old rules (formerly driving reactive behavior) were more like:
- don't fix it if it ain't broke
 - don't spend any money
 - it's not my job

Comment: The key is behavior--what people do. These are not espoused rules, what people say but do not do. Changing what we do, especially when under pressure or stress, to conform to new decision rules requires a paradigm shift in three dimensions: head (no reason to be against it), heart (willing to take the risk of using new rules, and body (having the skills to actually use the new rule properly).

Figure 12

The "bug picture" in Figure 11 is a visual way of saying that we "want to follow the new simple rules" of

- (1) Don't just fix it, improve it,
- (2) Focus on value, not cost
- (3) Maintain and enhance our license to operate and reputation

These are the new guiding principles for proactivity, captured in words. Our premise is that if you could truly do what figure 12 says, we couldn't avoid becoming proactive. This is the power of finding the right "simple rules" for action.

The focus of executive authority: business results

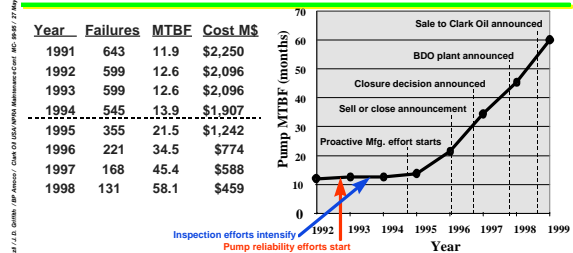
We are now going to shift attention to the role of the executive authority in all of this.

To extend what we have written in our papers of 1997 and 1998, see figure 13, which gives pump MTBF (mean time before failure) for Lima Refinery.

Figure 13 is an archetypal example of the dramatic changes and improvements experienced over the years from 1994 to 1998. We've shown this chart in our prior year's papers, but wanted to extend the data again this year to show that the learning rate we established was sustained over the longer haul.

A key outcome of these results is creating time for improvement work (as noted earlier in Figure 7). Instead of having to deal with 600 failures per year, we only had 131 in 1998. This is still 131 too many, but a big improvement vs. the starting point.

Lima Refinery: Pump Repairs MTBF quadrupled; costs down by \$1.5MM/yr.



In spite of the closure decision, pump MTBF and Planned Work continued to improve. Pump reliability increased by fivefold; costs dropped more than \$1.5 million per year. Maintenance switched from reactive repair of breakdowns to proactive defect elimination and prevention with a focus on operational discipline. Our learning culture enabled us to continue improving in spite of a very difficult situation, eventually resulting in sale of the asset to Clark Oil USA, a win-win-win for BP, for Clark, and for the employees/community.

Figure 13

These freed-up resources were redirected into further defect elimination work, further reducing breakdown events and time consumed by these, in many areas and types of equipment.

The cost savings are another key outcome. Spending \$1.5 million per year less on pump repairs gives a chance to spend more somewhere else, when needed, to make an improvement or to redesign.

A third outcome of success results (as in Figure 13) is belief that TPM type of performance is possible, *in our plant*. As fewer and fewer things break, people get more aware of defects and committed to eliminating them, and the "wall" of our paradigms (things have to break, we can't imagine a world where 99% of the breakdowns we experience in the reactive domain, etc.) can come down a little.

Each improvement, like pump reliability, takes a brick out of the wall, so that we can see the goal of TPM ("the precision domain") more clearly. So success is very motivational for defect elimination efforts.

Lastly, results like these are “hard evidence” to senior management and to outsiders that what we are preaching with TPM can actually work.

Concerns about Safety

During the two year period following announcement of closure, but while the refinery still had to operate, concerns were raised about employees leaving the refinery to find other jobs, prior to closure. How could we keep running well, and safely, as our experienced people left? How could we keep up morale, knowing the plant was to be closed?

At a leadership forum meeting, our “CI (Continuous Improvement) Forum,” we discussed this issue. It was helpful to have seen success to that point; so we noticed that the cheapest way, the best way, and the safest way, was to run the plant the proactive way.

We decided that we should continue the CI program.

We shifted emphasis to operational discipline, and safety, but still looked for value increases that we could pay back before the closure deadline.

The reasons for doing this were that we felt this was important to continue to hold to our vision (knowing what we were up against, with skills erosion), for safety and also to keep up morale.

Employees would be able to go out of the closed refinery with their heads held high, and tell prospective future employers that they knew how and had continued to practice disciplines that create proactivity. This would make them a more valuable employee to a future employer (so we thought).

So, we pushed on. 1997 and 1998 were difficult years. It was tough to keep up

morale, and many good people left, as they found new jobs elsewhere. By the end, about 110 people (of 440) had gone. So, imagine running the refinery, safely, with great performance metrics on safety, environmental, cost, reliability, etc. (not shown here) with this many fewer people.

This couldn't have happened without eliminating reactive type work

The only way this could have happened is as a consequence of not having so much reactive work to do. We eliminated a lot of the work that we used to do, so much so that many fewer people could run the plant.

Some work, such as design engineering, did not make as much sense to continue, so there was some reduction from these areas, but most of the ability to run with fewer people came from eliminating defects in the normal work of day to day operations and maintenance.

The attitude of people stayed positive. Instead of going “postal” or feeling helpless, this continued push to run well seems to have been just what people needed to stay focused and make it through each day. Senior managers would come from Cleveland or London and remark with surprise how well things were running and how people still had a good attitude and were improving things.

The role of line leaders and equipment specialists was very important, as the collective knowledge shrank down to fewer and fewer people. It is important to give credit to them here, as it is clear that without their contributions these sorts of improvements would not have happened. In many ways what our efforts towards Proactive Manufacturing merely accelerated what had already been started and ongoing years prior.

Prior to the start of Proactive Manufacturing in late 1994, several years of improvement

efforts led by the rotating equipment specialists had laid the groundwork and were generating improvements for the MTBF improvement noted in Figure 13. The Manufacturing Game™ workshops in 1994 and 1995 seem to have accelerated these initial efforts and communicated the intent and approach of the reliability group more widely in the organization.

Inspection department activities also greatly increased prior to the start of Proactive Manufacturing, and contributed greatly to increasing MTBF of piping, tanks, and other fixed equipment.

The big surprise: sale of the plant

In August 1998 a big surprise happened: Clark Oil USA purchased the Lima Refinery from BP, for \$215 million (\$175M for the plant and \$40M for inventories). This was a very positive thing for everyone.

The financial benefits of learning

Millions were added to the bottom line, but it required persistent application of the ideas of Proactive Manufacturing

- n Ongoing value add from Proactive Manufacturing amounted to about \$43 million per year, or \$0.77 per barrel (see our 1998 NPRA paper for details)
- n BP was able to sell an asset that had been slated for closure
 - Clark Oil paid BP \$175 million for the asset
- n Employees retained high paying jobs
- n The community retained tax revenues and benefits of ongoing operations to the local economy

All parties (BP, Clark, the community) attribute these results to the dedication of employees who created the future they wanted via operational excellence.

Figure 14

Employees benefited by retaining high paying jobs, and continue to run the refinery they loved. Colleagues who had worked together, almost as an extended family, were able to stay connected.

There was tremendous celebration and encouragement to the employees. The head of the union stated at the flag raising that (a paraphrase, not exact quote) that raising the Clark Oil flag on our flagpole

was one of the proudest moments of his life.

Why? Because the employees had saved the plant. Their excellent performance was the reason Clark Oil could purchase the plant in such good shape. Had we as a total plant not been able to run so well during the two year period after announcement of closure, there is no way that Clark Oil could have been attracted to the plant.

The Wall Street Journal wrote about this with the headline “Competent Workers and a Complex Leader Keep Big Oil in Check.”

To quote from the article:

“No matter how inevitable the forces of consolidation, the culture of a work force and the creativity of a community can still make a difference in the fate of a factory.”⁴

But saving jobs was not the whole point. Part of the motivation of employees to save the plant is that **we believed it was a good plant**, that should run.

If a refinery must close, it should be someone else’s less efficient, more polluting, higher cost refinery, of which there are examples nearby.

BP’s point of view was that the plant didn’t make enough money for their criteria, a valid perspective that an owner could very reasonably take.

Finding Clark Oil, who wanted to acquire a refinery, was a “win-win” situation for everyone.

To quote a key senior BP manager:

“This outcome is fully in line with our strategy and we are pleased to have achieved such a positive outcome for all concerned. Not only will the refinery remain in operation, but

⁴ Wall Street Journal, Section B1, Friday December 4, 1998

*BP Chemicals at Lima will continue with its expansion plans.*⁵

BP was able to reverse some of the accrued costs for closure and environmental remediation, which meant even more value from the sale.

BP also recognized the importance of the workers:

*"The excellent operating performance by Lima employees over the past two years made the refinery easy to represent to the buyer and was a critical factor in the success of the sale to Clark. Our only regret is that a quality offer did not emerge two years ago when we first tried to sell the refinery as we could have avoided a lot of uncertainty for employees and the Lima community."*⁵

The Wall Street Journal reported further on this story in a second article:

"When U.S. Budget Director David Stockman, (a principal in the Blackstone buyout firm that controlled Clark USA, an expanding merchant refiner) declared his interest, (it was with) some concerns. Which operations were already shut down? How many workers had been let go?

Keeping plant managers in the dark, the Lima (community) task force snoopied for answers. They found that while executing the staged shutdown, workers, astonishingly, were preserving the assets in pristine condition, just in case a qualified buyer stepped in.

Mr. Stockman had another worry: How permanent were the plant's productivity gains? More important, would they continue?

To provide credible answers, Mayor Berger turned to Jim Schaefer,... (former Manager of the Ohio Refining System). Though since departed from the oil business, Mr. Schaefer leapt at the chance to facilitate the sale of his old plant. In April (1998), he met Mr. Stockman at the Airport Marriott in Cleveland to detail the story of how an old refinery had attained world-

⁵ Shield Magazine (The International News Magazine of BP), Issue 2, 1998, page 57. Quotes from Iain Conn, senior vice president for BP Oil in the US, who concluded the deal with Clark Oil for the sale of the refinery.

*class status -- and how the culture of continuous improvement would survive a change in ownership. Mr. Stockman was convinced.*⁶

At the celebration and sale closing ceremony at the Lima Refinery gymnasium in August 1998, Clark Oil USA officials again reiterated that it was the performance, attitude, and skills demonstrated by the workers that made the essential difference in their decision to purchase the refinery.

The Wall Street Journal continues :

Since taking over the plant, says Brad Aldrich, an official of the Blackstone refining unit, "All our surprises have been positive."

*"I've never been involved in a transaction that was so well positioned as a win-win-win," says Iain Conn, the senior BP official who presided over the negotiations. Relations with the city had been tense, he admits. "But some of the people who were bloodied by that were able to say, "This is a correct final chapter.""*⁶

The Lima Community benefited from the sale by retaining the tax revenues and associated supplier / customer businesses which were connected to the refinery.

For the community it was also an emotional thing, since so much of the communities identity had been associated with the oil industry for so many years. The sale was a boost to confidence for everyone, and economic development efforts for the city have prospered since.

Much more could be said about the closure decision, and then sale. The main point here in all this is to highlight the vital importance of worker passion, commitment, engagement, and performance.

Real leadership emerged from workers, who took both responsibility and authority (within boundaries set by executive leaders) for improving the business.

⁶ **Wall Street Journal**, Section B1, Friday December 11, 1998.

Let's recap what we think were the key factors in achieving this by looking again at the steps in the journey.

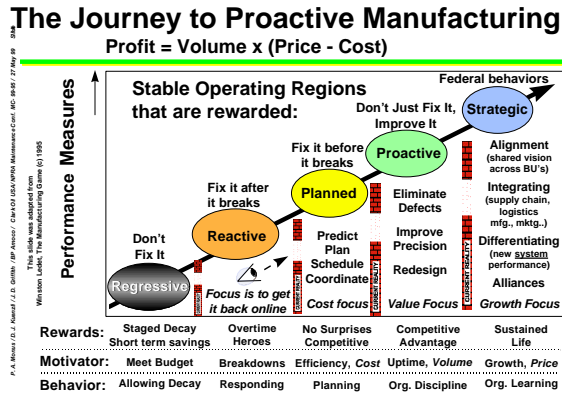


Figure 15

As was noted in our 1997 / 1998 papers, we are following the “stable domains” model developed at DuPont (see figure 15). If you want more details on this model, please refer back to our earlier papers.

As has been noted earlier, the TPM domain (we have labeled it the “proactive” domain in figure 15) is much higher performance than either the planned or reactive domains. Costs are up to 25% lower for maintenance, uptime is much higher (generating volume at no incremental fixed cost), and the quality of work life for people is much better.

Instead of fixing and fixing you have time to think about how to optimize the value of the business. People have time to meet and discuss problems and root causes. There is time to develop and grow our skills. There is time to think about new business opportunities and products, to grow value.

Achieving the benefits of planned maintenance still leaves a big distraction (getting the equipment running again) that often prevents spending adequate time on these things. The proactive (TPM) domain offers a chance for people to evolve from

thinking of themselves as a “mechanic” or “engineer” or “operator” and become a “business owner.” What would I do if this were my business?

This is a new type of thinking -- new behavior results from this new thinking. In figure 15 we see some of the key behaviors listed under the “Proactive (TPM) bubble”:

- 1) Eliminate defects
- 2) Improve precision of all work
- 3) Redesign equipment so it is fit for purposes of the business today
- 4) Focus more on long term value and sustainability, not on short term cost
- 5) Have the discipline, in the whole organization, to pursue the right things for proactivity, every day, in every decision
- 6) Make “don't just fix it, improve it” a daily reality that we live by

If we succeed in doing this, we get volume up (uptime on the equipment is higher, so volume typically increases), and cost down.

A business owner has only a few knobs to turn to increase profit: increase volume, increase price, or decrease cost.

$$\text{Profit} = \text{Volume} \times (\text{Price} - \text{Cost})$$

Getting everyone in the plant to see this simple formula in every decision is a key competence in being able to know what is appropriate for “don't just fix it, improve it.”

Going for the planned domain typically orients around lowering cost.

Going for the TPM domain typically focuses on uptime, which impact volume.

The Strategic domain has even better performance than the TPM or “precision” domain--some people call this performance level “world class manufacturing.”

Going for the Strategic Domain requires a different strategy than the TPM / Proactive domain. If your focus is to not be at the mercy of market conditions and the margins they give you, one must do something to fundamentally change the dynamics creating these market conditions.

The focus changes to a world of alliances, and outsourcing activities that can be better done by others who then become our strategic partners.

Maintaining alignment and finding ways to leverage value by differentiating what we offer customers, and/or integrating activities in the total supply chain, these are the sorts of behaviors required for the strategic domain.

Organizational learning seems to be a key requirement for achieving and sustaining the strategic domain. Without a shared vision and commitment to the “whole” the parts may behave in ways that erode performance over time.

Achieving what we call “Federal Behaviors” between assets and with strategic partners is a key to sustaining long life and growth.

There are many forces that push on the ability to do this; adapting to the changing environment, being learners (not ones who know) is vital.

Changing behaviors is not easy. There are multiple levels of change that must occur:

- 1) in our head (intellectual center)
- 2) in our heart (emotional center)
- 3) in our body (moving center)

While we all have experienced paradigm shifts in small and not so small ways over our lives, we tend to quickly forget how threatening and difficult the change can be to get through. The passage from one stable domain to another is hazardous.

To make the change, everyone has to shift their decision rules for action, and actually follow the new simple rules—this is a paradigm shift in 3 dimensions

Work of Paradigm Shifts

n Meaningful Work (head)

- change the challenge people experience in their work; mental energy goes into making the decisions
- decisions lead to testing / changing mental models, which leads to organizational learning
- leadership for this dimension is primarily the province of the network leader, who brings and promotes the ideas

n Risk Taking (heart)

- change the ability to overcome hazards; emotional energy goes into taking the risks
- risk taking leads to reducing the fear of change, which leads to realizing significant value
- leadership for this dimension is primarily the province of the executive authority, who sets the context and direction of the business, and rolls out programs based on the ideas available

n Skills (body)

- change the habits we use to do physical work; physical energy is used, making repetitions
- repetitions lead to changes in habits, from reactive habits to proactive habits
- leadership for this dimension is primarily the province of the line manager and the workers, who must translate the ideas into functioning via new habits and daily action to realize the value offered by the ideas available

Figure 16

Meaningful Work

To shift in the way we think, it helps to change the challenge we experience in our work. Intellectual energies come from the power of ideas. This is the source of activating change.

Until people have some idea of how to bring a change about, the desire to change is only imagination. The power of ideas comes from the ability of people to bring new value into existence by application of the idea.

Faced with tough new challenges we are pressed to use mental energy figuring out what we are up against, and then to make real decisions.

Decisions are something that require us to commit resources, with an uncertain outcome (risk), thereby testing our mental models against reality. If we must make a decision, we are forced to either hip shoot, or ascribe some sort of causal relationship in the decision that guides in choosing path A or path B. Then we get to feel the impact of the decision in the events that unfold later, thus either confirming our mental models or disconfirming them.

So a key need in transformational change is to bring in new ideas which have the power to transform a situation and thus

realize more value. Some of the ideas for and against proactive manufacturing are:⁷

For	Against
Defect elimination	Things must break
Planning	Resources are too busy
Scheduling	I can't make a difference
Inspections	They won't let me
Quality workmanship	I can't change
Design for evolution	Minimum capital cost
Collaboration	Internal competition
External competition	Complacency
Evolutionary change	Optimize destination
Synthesis of improvement	Analysis as Ultimate
Distributed Control of Change	Central control of change
Internal motivation	External motivation

If we take the time to reflect and learn, we can examine our “theories in use” and improve them—these are our “real” mental models--the ones we act by.

To get at our theory in use is a process that requires time, and is a discipline. Typically plant people are busy enough; we tend to spend insufficient time on reflection.

The Manufacturing Game™ workshops provided some infrastructure that helped us with this, in that participants in the workshops had to make many decisions, as a team, about resources, risk taking, and where to focus--an example might be the level of supplies they choose to stock in the storeroom vs. the risk of running out of parts for maintenance work.

⁷ WP Ledet, Manufacturing Game™ Facilitator Training Guide, Section 2, pp. 1-5.

As reality speaks to us, and as we reflect on what we thought prior vs. what happened, we learn. And we can change our thinking. Doing this is an organized way, with cross functional teams, gives a greater opportunity for organizational learning. Action teams also serve as a “practice field” for learning in this way.

Often a decision comes in the form of a feeling or movement, rather than a thought. To make good decisions, we should be thinking from the “whole person” (sizing up the situation in terms of thinking, emotions, and movements). True decisions require enough analysis to articulate the significant consequences, and evaluation of our skills and abilities to take the actions necessary, and an emotional judgment of our willingness to accept the risk involved.

Bennett describes decision making as “the commitment of resources to the achievement of an objective” (where *resources* are the material, human and intangible assets of an organization.) He goes on to say that “management decisions appear to be a choice of “yes or no” but this overlooks the subtlety of the commitment, which involves both the intention to achieve and objective and the judicious utilization of resources.”⁸

A key leadership element in this dimension is “idea.” Ideas are mental constructs that consist of a pattern of potentialities. The idea is in the minds of people. Since an objective is the realization of an idea, and since ideas must be embodied in events, realization of the idea requires commitment of resources. Ideas call for a decision, and a commitment of resources.

Ideas typically are the focus on the network leader, who typically are drawn to them, and go deep into understanding them fully.

⁸ JG Bennett, Relationships in Organization, pp 9-10, from the UniS collection of his papers.

They also contribute by helping others see the ideas more clearly.

The more meaningful the work we are doing when we are challenged in our thinking, the more significant and deep our ability to change will be.

Areas of our life or work that are really important to us, that we are thinking about incorrectly or imperfectly, tend to create significant emotional experiences for us when we are able to shift our thinking.

Risk Taking

There is some element of risk and exposure when we open our thinking up to challenge in front of others. But to learn we must also be willing to face and overcome hazards.

A second area we must change (for a paradigm shift to occur) is in our emotional center. This is also a part of us that is centered more in our right brain, and deals with intuition, values, and pictures.

The work involved here is to get a group of people to come together around a common purpose. The resistance we feel in trying to do this is the resistance of people to collaborate with each other to achieve the work. There seems to be a tendency to compete rather than collaborate. There seems to be some sort of an emotional feeling of risk for people to collaborate—“maybe you’ll get credit for my contribution,” or “if I share what I know, I’ll be less valued for my knowledge.” Overcoming these feelings and risks is the work involved in shifting our paradigms in our “emotional center.”

Emotional energies come from feelings we have about certain situations. These energies are connected to values we hold dear. These energies are expressed in the form of emotions. These emotions may or may not be appropriate to the situation at

hand, depending on how well developed our understanding of our values is, in this situation.

So, these emotions are a sign of value. But it may not be obvious to anyone what the value is.

Using these energies to make value judgments is a key need. The way we can do this is to evoke these values through archetypal experiences of the values associated with various aspects of human nature.

Each archetype has a need for certain types of feelings, and will interfere with accepting a new paradigm that has not created those feelings.

This is probably a reflection of the old adage, “no pain, no gain.” But facing pain, and unpleasant feelings is not something we like to do as humans. Most people don’t like risk, or threat.

Emotional energy goes into facing risks. By learning to face and overcome risks, we reduce the fear of change. Since change is a key factor in realizing new value, this emotional energy and risk taking is a vital part. Without this, the shift experienced in our thinking is shallow, and merely theoretical.

Leadership for this dimension of the paradigm shift comes primarily from executive authorities, but it can also come in smaller bites from everyone.

The executive authority sees the business context most clearly, and then has to make decisions where the outcome is uncertain. This was true for us as we considered committing ourselves to Manufacturing Game™ workshops in 1995. There were a lot of reasons to worry about this decision; would it work? Would the people we send actually participate?

Typically network leaders are overloading executive authorities with a plethora of good ideas that might work; making a choice and then living with the consequences of the rollout is a key role of the executive authority, as is saying no to some things. But line leaders play a key role in discriminating also, based on their capacity to implement the ideas.

The very act of discriminating between the ideas available is itself a risky act. The better the relationship between network leaders who promote the ideas and line leaders (who have to implement the ideas), the more likely it is that the rollout might succeed, and not be a “flavor of the month.”

Skills

To experience a paradigm shift, a person needs to reconcile all of the forces that are working against that new paradigm.

Several researchers suggest that a person does not experience a true paradigm shift until he/she has no physical, emotional, or intellectual objections to it.

So, even if thinking has shifted, and risks have been faced, the next step is changing our functioning, in the daily habits we have for doing our work. This is the dimension of our body, and the intelligence residing in our “moving center.”

The moving center has a certain intelligence to it. This intelligence participates in our actions and helps us learn how the world works. This is the intelligence that best knows the physical forces in the world and is best used to deal with these forces.

This is the intelligence behind the phenomena known as “choking” in sports. If you know you are not competent to perform at a certain level, your moving center will stop you by freezing up.

Most of the time, once we’ve learned a task or job, our moving center starts to operate in “auto pilot” for the repetitive tasks associated with the job. Changing the “auto pilot” to new habits of movement and behavior (even our lips, in speaking vs. listening for example) is part of the challenge of shifting this part of us.

Making a shift in our paradigm always involves the body. We must shift the patterns of physical movement and work we do, and this requires physical energy (not emotional or intellectual energy).

The more we can practice and repeat proactive habits of movement and action, the more ingrained and “automatic” they become.

Examples of this include knowing that we should always balance and align pumps properly, check that the piping is not under stress when doing a connect or disconnect, or to complete a thorough inspection of equipment as part of normal work.

In the reactive mode, the pattern of work is to just focus on the immediate task written on the job order, and not to look for and apply energy to all these other factors.

Leadership for shifting these patterns of physical work often come from line leaders and workers themselves. They must translate the idea (defect elimination, precise work, etc.) into practical ways of working that become new habits of physical movement and daily actions.

It is action on this level that realizes the value available. Having a pump with very little vibration, for example, is a consequence of doing all these physical tasks with precision.

Bearing all of this in mind, the leadership from executive authority in our story was

demonstrated via three main roles. See figure 17.

Roles of the executive authority in leading this change

- n **Decide and communicate the business context the organizational change must occur within**
 - Evaluate ideas that will be helpful in moving the organization forward
 - Make choices about what will be done and what will not
 - Take risks to create the change
- n **Create receptivity in line managers and workers for the ideas and initiatives needed**
 - Ensure that the status quo is destroyed and the change takes hold
 - Provide resources to accomplish ideas
 - Protect the network leader from harm
- n **Create a leadership forum**
 - celebrate successes
 - evaluate progress on the journey, dialogue with the organization about strategy and resources
 - create alignment of motivation and action for the next time period

Figure 17

First executive leaders understood and communicated the context and environment of the business, that line leaders and workers must function within.

The executive authority communicated clearly on

- (1) how fast change must occur
- (2) why change must occur, and
- (3) why we must take certain risks to create the needed change.

Performance goals were set in terms of a business mission. They were not stated in financial terms because financial results are consequences rather than goals. What we were looking for were some noble goals that would create passion in people because of the obvious value involved.

There were 4 Performance Goals articulated by the CI Forum in 1995 that have endured (see our earlier papers for more details):

1. **Maintain license to operate and enhance our reputation**
2. **Achieve maximum value from the asset**

3. **Maintain net positive cash flow**
4. **Be a learning organization**

Executive leaders used every opportunity to reinforce these as goals, and to use successful means to move towards these goals.

Secondly, executive authority created receptivity in line leaders, managers, supervisors, and workers for the change, and the ideas being rolled out to help improve the business.

Often the intent for initiatives or the reasons why they are important are lost on workers, or line leaders, who implement these only half heartedly. Getting from compliance behaviors to true internal commitment is the challenge.

Our situation required a more active step to destroy the status quo as prologue to the change initiative. Reengineering provided the initial “unfreezing.”

Secondly the low margin refining environment provided an external force that provided additional impetus for change.

Much later in the transformation the actions of BP London to sell / close the plant sealed our fates, and made return to status quo impossible.

The actions of all three leaders were important in making the transitional steps along the way that enabled the journey to improvement to continue; it could easily have stalled at many stops along the way.

Resources must be provided to support the line leaders and workers in being able to get sufficient skills or energy to overcome the challenges they face in implementing. This became a real issue once the decision had been taken to sell/close the plant. Most of the resources we used had to

come from our own internal “bootstrapping” process of improvement.

Executive leader(s) attended every Manufacturing Game to hear the debrief and give the client talk”

Senior management participated in every Manufacturing Game™ workshop session, being part of the circle on day 2, to listen.

They then gave the client talk outlining their view of the business context and why change must come.

The main point was to indicate that the status quo cannot remain, and to pledge support for new behaviors for proactivity.

The “client talk” on day 2 of the workshop kept improving, as executive leaders integrated their aspirations and vision for the future with comments made by attendees at workshops, learning from the Game itself, Action Teams, and CI Forum meetings. The business context and need for change became more and more clear with each time they gave the talk.

Speaking “from the heart” without a prepared message also helped; the message was clearly authentic. Workers and line leaders responded to the appeal from executive leaders, once the context and external forces became more vivid.

Executive leaders also led many other “punch up” activities to regenerate motivation, understanding, and continued action. Both of the senior managers played an active role in launching and facilitating action teams:

The site manager contributed by setting overall direction for the business and the big picture (hard and soft targets).

Other managers, including the plant availability manager (and other line leaders) contributed by translating the

ideas of the Manufacturing Game™ and “Learning Organization” into tasks and approaches that the rank and file could appreciate and apply.

At times the executive authority had to take action to protect network leaders and key “change agents” from harm. People who create change are not loved, and there is a lot written in the literature about network leaders who become seen as “heretics” and later have to “die on the cross” for their ideas.

During the early days, workers complained about “playing a game” when so many high stakes actions were being taken each day—it took the reinforcement of executive leaders to stay the course and support these workshops, or they would have died off in the face of pressures from daily work.

Learning how to align efforts of line leaders and network leaders who bring ideas is a key mediating role for executive leaders.

Executive authorities also created a “forum” for bringing the whole system together, periodically, for dialogue, learning, resource allocation, and strategy discussions.

Stopping daily work to take time for reflection and learning is a key new organizational infrastructure.

Developing a “roadmap”, vision, hard and soft targets, and action plans for implementing all of these emerged in the Lima Refinery “CI Forum.” See our prior year’s papers for more details on this.

Continuous Improvement Forum

A leadership process that created direction, space, and boundaries that line managers and workers needed to take empowerment and create action (The forum was owned and led by the refinery manager, yet a large amount of freedom and ownership emerged in everyone for implementing the ideas)

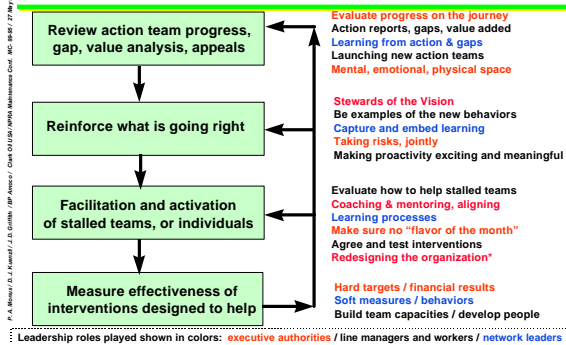


Figure 18

The network leader typically designed the meeting agenda for the leadership forum, and facilitated the meeting, working closely with executive leaders (to meet their goals), **but the meeting clearly was and must be owned by the authority, not the network leader.**

Creating the space (mental space, emotional space, and even the physical space) for these sorts of dialogues to occur was a major contribution of the authority.

Defining the boundaries, and then showing an attitude of trust and expectancy for results, asking good questions, having a learning attitude (not a knowing attitude) contributed to the energy and productivity of these meetings.

The basic agenda was pretty much the same each month: find out what the action teams were doing, what was going well and what wasn't, and learn from this.

Once the data of what happened was on the table, then we'd inquire into the meaning of these results. Then we'd decide if anything was noteworthy enough for celebration or application elsewhere (to reinforce what was going right), and also if facilitation of stalled or inactive teams was a good idea or not.

Typically a stalled team would not be given "help" in the early stages of their work. If they didn't have enough internal passion and energy to move forward on their own, they typically would be dying or dead. But some teams would ASK for help, and we'd help them.

The authority might offer a little encouragement or reproach for teams that died, if this was helpful in getting them to feel the seriousness of the issue and the need to do something about it. But it was up to action teams themselves to succeed.

In all of this, the authority had to walk the talk, and be an example, a steward, of the vision for proactivity and TPM levels of performance.

If the organization sensed any backsliding, they would let the authority know and test commitment. Workers and first level supervisors seem to have really good antennae, early warning systems, for noticing backsliding.

In some cases the authority did not realize how actions were seen or interpreted, and communication solved this.

In other cases there was real backsliding starting (to reactive behaviors) and the authority needed to have feet held to fire to restore commitment and stop the backsliding. An example of this would be budget pressure from headquarters vs. a commitment to keep pursuing value and improvement.

Designing a gainsharing program that drives proactivity / performance

Getting beyond the culture of the hero, and designing rewards and recognition systems to reinforce proactivity is another example.

During the two year "closure period" of operation, a new gainsharing program was adopted. Instead of goals being "whether

we are better than another company” or “percent improvement more than last year” or other more common approaches, the gainsharing program designed for the last two years of operation had all the metrics driving rewards “local.”

- 1) locally selected and administered
- 2) totally achievable by plant people themselves
- 3) based on high leverage measures that would drive proactive behaviors

For example, if you achieved an improvement in pump MTBF from x to y, you could get z% payout. If you lowered oil flow to the sewer by w gallons per minute, you could get v% payout. If we reduced hydrocarbons burned in the flare by u%, we'd get t%.

All told, up to 22% of salary was made available to everyone in gainsharing. It was to be paid out every six months, and big celebrations accompanied revealing the percentage.

These were fun events, usually with a steak dinner for everyone, and lots of cutting up by management and workers. Safety goals and other key “license to operate” were high in the priority for gainsharing, and these meetings were used also to promote safety and operational discipline, and to share what was going on in the business environment, so everyone could participate.

Getting the right hard targets to drive gainsharing, getting behaviors and leadership from management and supervisors right, getting alignment of intent and strategy, and resulting resource allocation between areas for the overall good of the refinery, these were all key roles of the CI Forum.

Risk taking

- n **Capturing value requires taking risks**
 - remember the value, when assessing the risk
 - mitigate the risk when you can
 - lots of small risks add up to one big risk; safer, everyone can help
- n **Clear boundaries**
 - within which smart risks can be taken
- n **Sharing risks**
 - between functions, areas
- n **It was a big risk to bet the future on success of the action team approach**
 - We needed a way to rapidly engage the whole organization
 - We weren't sure it would work at first, but people were enthusiastic
 - Early success with action teams convinced us there was a lot of value to be had and that this could work
 - We learned how to do this as we did it (like redesigning the airplane during flight)

Figure 19

Risk taking for value

Executive leaders must provide clear boundaries within which smart risks can be taken.

Examples of this might be direction on how much money can be invested in improvement activity, on faith that repeat “reactive” work will decrease. Another example would be giving more leniency if an area goes over budget for a while, to create the change.

Line leaders also must risk, but their issue is more about *how to share* risks (example is sharing money between areas; if I give you my money now, will you give me your money later when I need some?)

Functions also must share risks (i.e. operations will allow maintenance more time to finish a job properly, vs. rushing them; if the spare fails during this extra time, they will not blame maintenance, but see this as a shared risk).

Workers need to learn to have courage, and take smart small risks, and not put the burden of all risk taking on supervision or leaders.

In 1994 there was insufficient money for all the work needed to be done during the turnaround, so a risk was taken (at the advice of the technical specialists looking at

rotating equipment) to defer normal compressor teardown and rework, on the bet that the compressors would last four additional years reliably without doing the normal “turnaround.”

This looked at the time like a good risk, as condition monitoring data and oil samples indicated no problems, and the rotating specialists advised that tearing down and rebuilding the compressors had an equal risk of introducing defects. This turned out to be a good risk in fact, as the compressors lasted until 1998 without failing. Deferring this work liberated money (from the compressor work) to be used for other improvement activity during the turnaround.

Another example: approximately \$2 million dollars per year was invested in improvement activity (a big increase vs. normal) and was always paid back during the year (never went over budget) on short term small projects. Justification for this money was made more simple and logical, less bureaucratic: if area team leaders could agree there was a short term payback, they could have the money (less “prove it to me” mentality).

Making approval of improvement projects more easy to justify “locally” was a risk for our executive leaders (with their seniors in Cleveland and London).

Going for the action team approach (instead of the traditional approach of planned maintenance) was another huge risk for executive leaders to take, based on the need for improvement in less than 1 year. There was no assurance this “experiment” would work here. They went for this approach out of intuition, not proven fact.

So, why did this approach work?

WHAT DOES IT TAKE TO CREATE PROACTIVITY?

- n **SKILL - Functional in Nature**
 - Training
 - Tools
 - Technology
- n **CAPACITY - Energetic in Nature**
 - For decision making
 - For two way communication
 - For physical work
- n **MOTIVATION - Activating in Nature**
 - Authority
 - Ideas
 - Worker

Figure 20

Figure 20 outlines three main areas needed to create proactivity: skills, capacity, and motivation.

Skills are functional in nature, and have to do with having the right training, tools, and technology available to do the work properly. We were not lacking in these skills.

Capacity has to do with energy available in the organization, mainly in the people who run the business. It has to do with having enough people do the work tasks, and all the activities around running the plant and satisfying customers.

Capacity also has to do with energy available for *two way* communication, or “social work” in the organization. This seems to come from a type of “sensitive” energy which is a capacity people must cultivate.

Lastly, there is a capacity for decision making, dealing with uncertainty and risk, and doing the mental work involved in all of this.

We were not lacking in any of these capacities; we had good people, enough of them, and yet we entered this change effort stuck in the reactive mode.

The key problem was motivation.

Motivation is the key challenge

If you think about it, almost any challenge can be overcome, with sufficient motivation. John F. Kennedy's challenge of putting a man on the moon by the end of the 1960's was a huge problem. But people saw it as significant, and rose to the challenge.

Proactivity is the same sort of thing; everyone has to play their role: from the executive leader (Kennedy in this example), the network leaders (the guys in NASA telling him it could be done, who Kennedy trusted and listened to before making his speech), down to the line leaders and workers (all the people who did the daily work to make the idea reality).

Once motivation is there, then significant evolution can occur. Next question: what if motivation isn't there? What if good ideas languish and fail to be implemented?

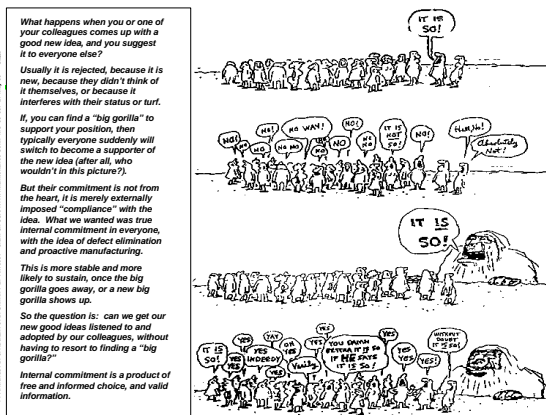


Figure 21

Figure 21 shows one way that we can deal with getting our ideas implemented.

What happens when you or one of your colleagues comes up with a good new idea, and you suggest it to everyone else?

Usually it is rejected, because it is new, because they didn't think of it themselves, or because it interferes with their status or turf.

If you can find a "big gorilla" to support your position, then typically everyone suddenly will switch to become a supporter of the new idea (after all, who wouldn't in this picture?).

{The big gorilla is typically an executive leader, but may be a customer, supplier, community, or a regulatory body}

But commitment levels in our colleagues is not from the heart, it is merely externally imposed "compliance" with the idea. What we wanted was true internal commitment in everyone, with the idea of defect elimination and proactive manufacturing.

This is more stable and more likely to sustain, once the big gorilla goes away, or a new big gorilla shows up.

So the question is: can we get our new good ideas listened to and adopted by our colleagues, without having to resort to finding a "big gorilla"?

Internal commitment is a product of free and informed choice, and valid information.

Traditional approaches depend on Authorities to initiate change

Authorities' receptivity to ideas, and willingness to risk, change, and delegate (degree of unfrozenness, dissatisfaction with status quo)

Figure 22

Traditionally, change is driven by Authority, who assess the need to change, and take the risks associated with change.

Examples include re-engineering, the traditional approach to planned maintenance, and breakthrough thinking approaches.

One problem with this is that often Authorities are not close to the work and thus do not have close access to where the high leverage points in the system are (source of low hanging fruit), and are also not as able to see possible unintended consequences of interventions. This leads to worker dissatisfaction and a feeling of “flavor of the month” as Authorities continue to test new approaches for change, mostly without achieving promised results.

Even successful programs can be stopped when a new Authority with differing mental models takes over.

New ideas often challenge existing paradigms, and thus can be threatening to Authority, So, it is a rare authority who is open enough to radical new ideas to take a big risk to drive breakthrough change.

Another possibility is for change to originate at the grass roots

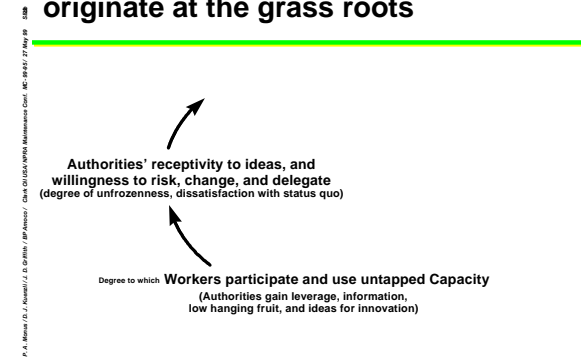


Figure 23

If change could originate at the grass roots level, via Worker’s use of untapped capacity in themselves, to create value for themselves and in their own work, this can become a driving force for motivating and also guiding Authority in the change effort.

Workers who want their equipment and / or processes to be defect free and reliable, for “noble” reasons such as safety, pride of workmanship, and job security, could share risks and make a series of smaller changes that add up to a significant cumulative effect.

By the commitment and action of Workers, Authorities become more receptive to ideas, and more willing to risk, change, and delegate.

Neither worker nor Authority can succeed by themselves

To win, a partnership must create the right environment for learning, sharing risk, and creating value--by taking action to pursue the right ideas in a sensitive way. Trust and action must grow together to sustain empowerment.

Through working with each other, Authorities and Workers contribute to each other’s success, which strengthens their desire to collaborate.

Authorities set boundaries based on overall direction and context of the business, and then provide space for action and experimentation and innovation.

Both Authority and Worker must create learning processes that build shared vision. Both must contribute to everyone increasing understanding and commitment to optimizing the whole system (not the parts).

Productive conversations must occur, even around difficult issues with widely differing perspectives. A key aspect of the environment is building an atmosphere of trust and truth, for the common good.

Power must be shared and leadership must emerge from all levels and parts of the organization. A balance of power (no one is too powerful) requires continued dialogue

and building and sustaining alignment up/down and across as a normal part of working.

People begin to really feel that they matter, that they are making a difference--for themselves, for the company, and for society and the world.

The environment is fast paced, and demanding. Everyone gives and receives help to achieve high performance.

If this is a picture of the “environment” that must be co-created, it is an “end state.” To move in this direction a series of small steps must be taken towards these end states, each of which helps co create the environment and produce the positive results we are seeking.

Once this gets going, it becomes a success loop, and is self reinforcing

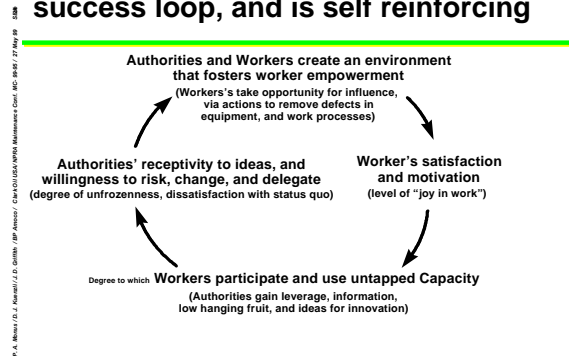


Figure 24

One round is not enough. This loop builds strength by repeated cycles, via mythic stories of success that build credibility.

In time this opens more willingness in Authorities and Workers to create and sustain the environment needed for increasing overall capacity for effective action.

While this cycle can go in the success direction, it can also become a vicious cycle. The quality of the idea determines whether the loop is virtuous or vicious.

“Joy in work” provides motivation

Figure 24 notes that an outcome of creating the right environment for worker empowerment is “joy in work,” which as WE Deming has noted is one of the most powerful motivating factors we can access.

Workers feel more satisfaction in daily work, as they are allowed time and resources to do a good job.

Winston Churchill once said that “morale is a sense that what we are doing is the right thing.” As internal conviction that “we are doing the right thing” builds up in workers, they feel higher job satisfaction and morale builds as well.

Pursuing proactivity was a very motivational thing for us. It was probably the main thing that sustained us in the difficult times during the two years we had to operate after the announcement of sell / close.

As worker morale and satisfaction go up, they become more willing to take the risks of participating in action teams and trying to make improvements. They then access more untapped capacity in themselves, creating more improvements.

As they create even more improvements, they build receptivity in the authorities, who then delegate, support them, and join in the risk taking for value, which in turn helps co create an even better environment for cross functional working and learning, which in turn leads to better action team results and even more joy in work and worker morale.

This loop becomes “self reinforcing” (a virtuous loop) that builds and builds, until something stops it.

In time these repeated experiences of proactivity build new habits of behavior and thinking, that sustain willingness in Authorities and Workers to keep on co-

creating environment needed for increasing overall capacity for effective action, cross functionally, cross area, and collectively.

Figure 25 shows how we started all of this in 1994.

Pressure was on from senior management to turn performance at BP's two refineries in Ohio around within 3 years, "or else."

Many other good actions were underway in parallel to this change effort starting.

Idea catalyzed change

Proactive Manufacturing at Lima started when the network leader brought the idea to workers and line managers via Manufacturing Game, supported by a few line managers who helped with cat herding

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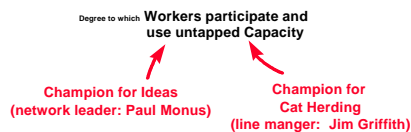


Figure 25

Proactive Manufacturing was initiated via a "bottoms up" process--it did not come from London or Cleveland or even management. It came from a reliability specialist *who brought the idea and method back to the refinery*, after experiencing a Manufacturing Game™ workshop elsewhere.

So, in this way, a new approach, a new understanding of the ideas of defect elimination, systems thinking, productive working together cross functionally, and many other concepts of TPM came to Lima Refinery, in the form of the Manufacturing Game™ workshop. Because the approach involved "playing a game" receptivity to the idea was at first pretty low. We had to sell the idea as "learning the benchmarking results DuPont spent a lot of money getting."

A few champions for the idea banded together with some line leaders who were looking for a way of implementing a vague concept they thought of as "proactive maintenance." Our understanding of what DuPont had achieved was low, and those who pursued the idea in the early days were doing so more out of intuition than certainty or logic.

But we got some results right away, from the first few workshops, which built our confidence this could work.

Some of the workers saw the need to become committed to the cause of Proactive Manufacturing, especially those involved with pump reliability.

They then enrolled management into joining forces.

One story has a training coordinator, who normally would never approach much less cajole our manager of the two Ohio refineries, "practically choke {the senior manager over these refineries} by the neck" to get him to commit to attend a Manufacturing Game™ session.

This manager joined a session in late 1994 in Toledo; this turned out to be a key step, as he later wrote a positive article in a plant newsletter, and then was a force that created receptivity in other executive leaders. There are many other stories about how lower level champions for this approach enrolled their seniors, playing a key role in creating receptivity in executive leaders.

The key point here is that workers initiated this change, not the big gorilla. It was bottoms up change.

But the champions are not enough-

Reflection on action must occur, so that learning is not left to chance; this requires new organizational infrastructure, which we provided via monthly leadership forum meetings

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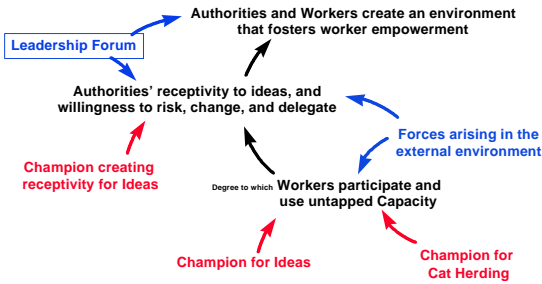


Figure 26

But, Authority came to become a force enabling this change effort when executive leaders became enrolled. Our new manager over the two refineries in Ohio (having just come from a role in commercial / supply departments) was adamant that we not repeat the same mistakes leading to plant unreliability. He did not want repeat failures. He always asked what we are doing to make sure a failure was not repeated.

Early on this behavior was from executive leaders to the refinery management team; later it was workers asking fellow workers and their managers the same questions.

Workers felt that they had the skills and capacity to learn what to do to eliminate repeat failure causes if management would only allow them the time and resources (including \$) to do it. Believing they'd be allowed to do it was part of the "environment" we think we created.

We saw no alternatives to proactivity

As the external world, and the pressures of low margins pressed in we got more motivated that this journey was the ONLY reasonable option available to us. The only other option was to get out a large chain saw and cut off arms and legs (figuratively speaking). Not wanting to just cut cost (we didn't believe this was the right thing to do, nor sustainable), what else could we do?

We could achieve the benefits of the precision domain, and TPM levels of performance; this was a vision we could see and buy into.

Another thing that helped us, in Figure 26, was that *multiple* champions emerged for each of the three kinds of leadership, and teamwork developed within each role.

The CI Forum was another important structure in this as well, as it both fed the receptivity of executive leaders and helped to co-create the needed environment for change and empowerment, just enough push each month, not to break the system or stall.

Reflection on action and results started to be a regular thing, which kept us going forward.

*As this loop becomes virtuous, other forces come into play
Defect elimination is a powerful idea that can go a long way and will create proactivity, but will run into limiting forces that slow improvement when capacity limits are reached*

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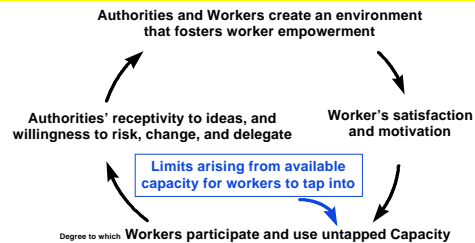


Figure 27

This process will run to its end after all the defects in the existing process and work are removed. This represents the end of "untapped capacity" that workers can access and use. So in this way the idea of defect elimination is powerful, but not sufficient to provide motivation forever.

Another good idea is needed for "round 2" after one reaches the precision domain.

But we were so far from this when we started, we couldn't even imagine this at the time. We found that we had virtually unlimited "untapped" capacity in workers, with many good ideas that could be accessed via action teams.

Reluctance to try this approach

Because this "action team" approach of self organizing teams is so dependent on workers, who must freely choose to use their own untapped capacity for action, management might be hesitant to try it.

Comments emerge, like "We can't control the results" or "We don't have the motivation in our people," or "I can't take the risk of doing it this way."

To succeed we think you must assemble a management / leadership team that exhibits all three forms of leadership, in an aligned and coordinated way.

"executing" the strategy in a coordinated way as the rollout unfolds.

Without all three leadership roles played properly, or without aligned implementation, some success can be achieved (with the action teams), but organizational transformation will likely not occur; the old forces sustaining the status quo will prevail in that case.

Timing must be right

Diagnosing when to start an effort like this is key; for example don't have any big distractions like a turnaround happening during the implementation year. Another timing issue is to make sure unfreezing activities (such as our reengineering) which disrupt the organization are completed prior to starting. Thirdly, it is important to get the right people lined up, with the right capacities and motivations, for each of the three leadership roles prior to starting.

This approach will work, but success is not easy

n Actions of each of the three types of leadership must align with and coordinate with each other

- these elements are like modules in a computer software program
- the computer "program" will bomb if there are defects in the implementation, in any of the three elements
- some success can be achieved with the action teams without alignment of the three elements, but organizational transformation will likely not occur; the old forces sustaining the status quo will prevail in that case

n Timing must be right

- diagnosing when to start an effort like this is key; for example don't have any big distractions like a turnaround happening during the implementation year
- make sure unfreezing activities (such as our reengineering) which disrupt the organization are completed prior to starting
- get the right people lined up, with the right capacities and motivations, for each of the three leadership roles prior to starting

Figure 28

It is almost like "software" whereby all parts of the code must work properly (individually) but also in a way that allows the whole thing to run as well. Imagine your spreadsheet that adds and subtracts, but does not multiply or divide.

Getting the leadership right is like getting both the individual parts right (genuine leadership in all three elements, playing the needed roles properly), but then

Learnings and conclusions

- *The ability to create a mass movement depends on alignment of actions and motivations arising from idea, worker, and authority*
- Anyone can destroy proactivity by introducing defects (esp. true for operations function)
- No one by themselves can create proactivity (must be a collective action)
- Authorities are looking for good ideas to implement and back
- Workers are looking for ways to influence authorities to be receptive to their ideas
- A good idea is hard to find, but once introduced takes on a life of its own (no one can stop a good idea-- it lives)

Figure 29

Figure 29 gives our overall summary

1. The ability to create a mass movement depends on alignment of actions and motivations arising from idea, worker, and authority
2. Anyone can destroy proactivity by introducing defects (esp. true for operations function)
3. No one by themselves can create proactivity (must be a collective action)
4. Authorities are looking for good ideas to implement and back
5. Workers are looking for ways to influence authorities to be receptive to their ideas
6. A good idea is hard to find, but once introduced takes on a life of its own (no one can stop a good idea-- it lives)

It is the motivation for proactivity that is the most important contribution. We think the Manufacturing Game™ workshops played a key role in creating this motivation, via a shared experiential understanding of both the end state and the journey from the reactive starting point to the end state.

Conclusions

Shifting mental models and behaviors is a difficult task, that requires new forms of leadership capacity and action. We think that splitting up the leadership roles into three distinct sorts of roles, for idea, authority, and worker, helps to make more

clear the needed leadership aspects to create an organizational evolution.

Lima Refinery is an example of transformational change that was designed, and succeeded--beating the high failure rates normally seen in change efforts.

We think the Lima experience of breakthrough change is replicatable elsewhere, but will have to take a new form in each new place.

During the conference we will address some questions we have had about our own experience of leadership, in these three roles, as noted in Figure 30.

Dialogue questions for Don, Jim, and Paul to reflect on together

- **How did we create the motivation for this change?**
 - What was the role of external forces in motivating the change?
 - Could this be done as an aspirational thing, even in a place with no desperation?
 - Can Lima Refinery success be replicated elsewhere?
 - Do you have to have a crisis to start this?
- **What led Don, and Jim to become receptive to the ideas of Proactive Manufacturing?**
 - Talk about risk taking, being a maverick, and creating something new, vs. "following a proven path"?
 - What led Don to provide the resources, even exceed a budget if necessary, or add people (such as analyzer techs), showing confidence that failure reductions would more than offset the extra cost?
- **How do we find the right people to play the three champion roles, and develop the interactions as we did?**
 - Were we just lucky, or was there some intuition on who would support us? Can people be developed for these roles? What led managers to let go of control, and tolerate some chaos and confusion?
- **What was the role in reengineering in setting up the change, and why were we able to tolerate going out of control (many managers won't do this)?**
 - Destroying the status quo; power sharing matrix structure vs. strong area team leaders etc
 - Talk about empowerment: pitfalls, difficulties, important steps forward and backward, the union attitude
 - Tearing down traditional department walls, maintenance, operations, engineering etc

Figure 30

Then we will address questions and comments from the conference.

Questions for dialogue between Kuenzli, Griffith, and Monus:

How did we create the motivation for this change?

- What was the role of external forces in motivating the change?
- Could this be done as an aspirational thing, even in a place with no desperation?
- Can Lima Refinery success be replicated elsewhere?
- Do you have to have a crisis to start this?

What led Don, and Jim to become receptive to the ideas of Proactive Manufacturing?

- Talk about risk taking, being a maverick, and creating something new, vs. “following a proven path”?
- What led Don and Jim to provide the resources, even exceed a budget if necessary, or add people (such as analyzer techs), showing confidence that failure reductions would more than offset the extra cost?

How do we find the right people to play the three champion roles, and develop the interactions as we did?

- Were we just lucky, or was there some intuition on who would support us?
- Can people be developed for these roles?
- What led managers to let go of control, and tolerate some chaos and confusion?

What was the role in reengineering in setting up the change, and why were we able to tolerate going out of control (many managers won't do this)?

- Destroying the status quo; power sharing matrix structure vs. strong area team leaders etc.
- Talk about empowerment: pitfalls, difficulties, important steps forward and backward, the union attitude
- Tearing down traditional department walls, maintenance, operations, engineering etc.

APPENDIX 1:

Abridged excerpts of 1997 paper: MC 97-89

The Business Situation We Faced

In 1992, Lima Refinery had slipped from its historic excellence to being caught in a vicious circle of reactive operations. Tight refining margins and several major incidents in the plant created significant pressure to improve.

By 1993, we faced a demoralized people environment, including an uncooperative union leadership, partially caused by fear of downsizing linked to a business process reengineering project.

Many employees had lost faith in management's ability to improve the financial results for the refinery.

Consultants brought in to re-engineer the work flow in 1993 had the effect of shaking things up, but had left many people in unclear roles, with an increased feeling of disarray.

Reengineering (by itself) failed to produce the promised financial improvements, partially due to defensive behaviors from the union and salaried employees—people seemed to be taking less ownership and responsibility for the plant.

Like most facilities, we had made many attempts at moving towards more reliable operations. At times we would have a good preventative maintenance program, only to see it somehow fall out of use or be stopped by a manager who did not see the value or who felt compelled to achieve a rapid cost cut. We had gone through similar fits and starts with Planning and Scheduling, Condition Monitoring, stores reduction and Predictive Maintenance Techniques.

All of these efforts produced some initial wins but sort of lost steam over time and had disappeared over the years only to be resurrected again and again. We pondered the question, "Why have past efforts of dedicated individuals in maintenance programs at Lima Refinery failed to produce a complete transformation to the proactive mode?"

The leadership team at Lima knew that we needed to turn things around but it was also

obvious that there was no easy solution. It seemed like nearly everyone had different views of what changes were needed, and how to implement change.

The notion of "continuous improvement" meant very different things to different groups in the refinery. For many it meant speeding up the treadmill, and downsizing, so the attitude was "why should I help do this to myself?"

We were looking for a way to build a shared vision for a journey of improvement to align individual goals with company goals, to gain support for improvement from all employees and to launch the action required to get improvements made.

The Proactive Manufacturing Process

To get the most out of our resources we knew we needed a means of engaging everyone in eliminating defects and the sources of defects that limit us.

As we started working to eliminate defects, we at first focused on improving maintenance. We then realized that we couldn't improve maintenance by itself, but had to do this improvement within the context of the whole of manufacturing. And to do this required having a means of surfacing, challenging, and then changing some of our most deeply held ideas and behaviors in the plant.

We realized that in order to make any process improvement be effective and sustained, we needed a means of working on thinking and behavior--for everyone in the bigger system--from top to bottom.

The Manufacturing Game: Organizational Learning for Everyone On-site

The game had been created at DuPont as a product of over three years of benchmarking work to understand the nature of world-class maintenance and reliability. The creators at DuPont started with this mountain of benchmarking data and a question that was eerily similar to the one we had at Lima, "Why do we fail to sustain improvements in maintenance and reliability and perform well below world-class standards in spite of the fact that all of the components of world-class performance are well known to us?"

The result of this study was a detailed systems model of how reliability works and why organizationally it is so hard to improve. From this detailed model DuPont built a board game representing operations, maintenance, and business services. The game uses poker chips to represent the products, supplies, and resources involved in manufacturing. The game is part of a two day workshop that focuses on creating the shared vision of what can be accomplished and what needs to be done to make these improvements happen.

The Manufacturing Game™ -- a practice field for learning

--virtual reality to engage everyone in taking action for improvement

P. A. Monus / D. J. Kuenzli / D. Griffith / BP Amoco / NPRA Maintenance Conf. / 7/1 May 98



Operations, Maint., Commercial fcn.

Team of six start in a reactive way of working, and must figure out how to evolve and breakthrough to a proactive way of work

Engage head, heart, body

Simple rules in use emerge

- the game creates passion, energy, and is real to life
- people can visualize and reflect on their "theory in use"
- meaningful work, risk taking, skills
- a safe "container;" OK to make mistakes
- then apply the learning back into the real world

figure 31: The Manufacturing Game™

The creators of The Manufacturing Game™ had succeeded in building a virtual world of plant operations that was a structurally accurate representation of how a process manufacturing facility and organization work. They had proven within DuPont that this tool could express the complex concepts that they had uncovered, in a way that was meaningful for people at all levels in the organization. "Learning by doing" in the Manufacturing Game™ workshop provides actionable knowledge, even if people cannot articulate any theory about what they have experienced.

We brought in Winston Ledet, one of the originators of the game in DuPont to facilitate our first session. Ledet had recently left DuPont to form a company to deliver The Manufacturing Game™ workshops to other companies. Starting with that first session the light bulbs started to go on. The leadership team saw that this was the perfect tool for engaging the front line in organizational learning. From the early sessions with The Manufacturing Game™, we

had five new insights that were significant "aha" experiences for us.

Insight 1: Reliability and maintenance are all about how you deal with defects in the total manufacturing system

Most maintenance efforts and information systems are all about removing defects more efficiently and not about stopping the inflow of defects.

Stopping the inflow requires participation and cooperation from all functions. Therefore, reliability is not a maintenance issue; it is a manufacturing issue in that all of the functions affect reliability and all benefit from its improvement.

We came to see that interdependence in the SYSTEM (Operations, Maintenance, Storehouse, Design Engineering and Commercial aspects) and how all the parts interconnect is really the core issue.

This meant that if we wanted to improve quickly we had to do two things:

- (1) take defects out of all parts of the bigger SYSTEM
- (2) shut off the inflow of defects at their source.

Insight 2: We must be very careful in what we consider to be goals.

Many of the things we called goals were really either consequences or means. Lower maintenance cost is a consequence of less repair work; reducing the maintenance budget without reducing the work just means not doing things that need to be done.

Insight 3: There are several stable operating regions⁹ of manufacturing (Referring to Figure 15 in the main paper)

Each of the stable domains has the characteristic that it is mutually reinforcing. This insight caused us to challenge and change our policies and practices: making this kind of breakthrough performance improvement requires moving from one stable domain to another. What works in a lower stable domain is often the wrong thing for higher domains, so

⁹ The concept of stable domains originated out of work by Nobel prize winning professor Ilya Prigogine and was later adapted to human systems.

being open and willing to experiment with new approaches is needed. We often resist these changes. Having a place to test structural changes collectively with the team with whom you must take action translates this theoretical insight into “new muscle memory.”

This is one reason why the Manufacturing Game™ is so effective—it allows teams to operationalize their ideas for structural changes and find out what happens in accelerated time.

Insight #4: Tapping into intrinsic motivation

Intrinsic motivation is required to succeed on the journey to higher stable domains. With higher levels of intrinsic motivation, creating new capacity to achieve high performance becomes an ongoing part of everyone’s activity, while extrinsic motivators such as fear or crisis only are active when levels of desperation are strong.

Articulating values and vision

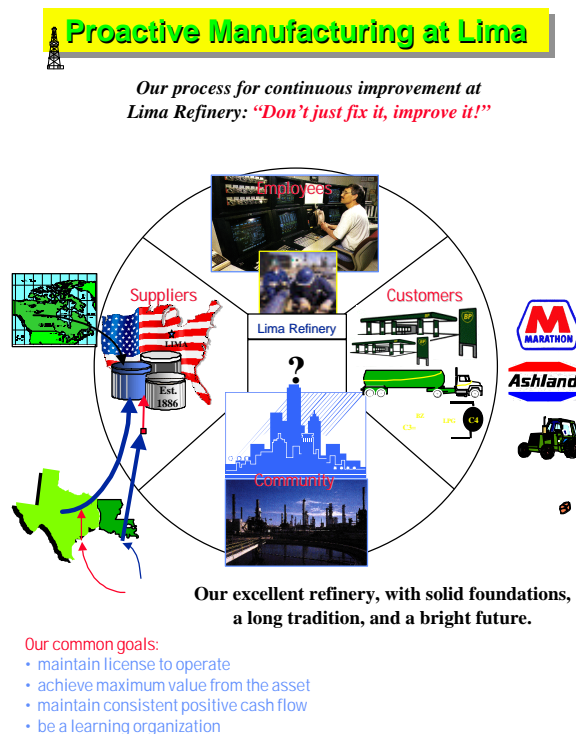


figure 32

We struggled with how to engage the hearts as well as minds of everyone. Clearly one of the barriers was our capacity for dealing with defensive behaviors and the ability to raise

difficult or threatening topics and then make these discussible.

The plant management developed a deeper capacity to listen to the organization, and to respond with inquiry rather than advocacy or to justify their position.

We captured our collective thinking and views in a graphic picture (figure 32) which we then put into all the control rooms, and meeting rooms and many offices. Much more should be said about this, but we won’t expand on this in this abridged appendix. Suffice it to say we wanted to express all our vision and goals in picture form. This is like knowing what it means to be an American by looking at the American flag. If you are not from America, you don’t get all the same meanings and emotions, as someone who understands these meanings evoked by the symbolism of our flag would.

Insight #5: Focus on low hanging fruit and what you have passion for.

This approach will create time to go after the big dollar items later. Building skill by working the smaller things first gives hope (we really can do this successfully) and creates the needed time to focus on the harder things. We used the “90 day rule” to test whether the scope we were going after was small enough—if progress couldn’t be made in 90 days, people probably would give up.

The approach we adopted

We developed a plan based on these insights to engage the entire organization in moving to what we started calling Proactive Manufacturing. As a philosophy we adopted “Don’t Just Fix It, Improve It”. We decided to run two Manufacturing Game™ workshops each month for the next nine months (in 1995) to offer every person in the refinery an opportunity to attend with the goal of building shared vision of where we were headed. The workshops created the enthusiasm and launched the action that we knew we needed.

We also decided to use the concept of action teams (small cross-functional teams that are put together with the idea of solving a specific problem or going after a specific opportunity) to go after specific short term projects (60-90 days). These teams would disband once the

project was complete or in 90 days if nothing was happening.

Improvising as we went

Our learning process continued as we implemented our plan. We discovered that our people could accomplish a lot more than we ever would have believed and we also learned about several obstacles that we did not anticipate.

Using the knowledge we already had

One of the biggest surprises was the improvement that we got from simply having people use the tools and techniques that they already knew on a consistent basis.

Front-Line Buy-in

Using The Manufacturing Game™ workshops and action teams turned out to be a great way to engage our front-line and the union leadership. When we got down to talking about how the refinery should run, we found that there was a lot of agreement and that we all wanted basically the same things.

We found that action teams and defect elimination took a great deal of cost out of the organization. These savings could then be applied to the investment required for more traditional maintenance improvement approaches, creating a virtuous, self reinforcing process. The Butane Action Team at Lima is a perfect example of this cost saving dynamic.

Birth of the CI Forum

After the Manufacturing Game™ workshops had been happening for nearly a year, we recognized that we still had not been able to articulate our philosophy for Continuous Improvement (CI), our vision for the refinery, or even to reach true alignment even on the nature of current reality.

To develop our roadmap (not described in this paper) -- to get from a commonly agreed starting point, our current reality, to where we wanted to go, our vision -- we at first thought we'd form a "steering team" to drive this. The first meetings were just senior managers in the refinery, plus a few helpers who were involved in facilitating proactive manufacturing. As we debated our philosophy, we decided that instead

of a "steering" team, what we needed and wanted was a "forum" where anyone, regardless of positional status in the organization, could contribute their ideas and energy. We then opened up meetings to a much wider cross section of the refinery, and renamed the steering group the "CI Forum."

Improvement requires evolution

In some ways what reengineering tried to do earlier was to leap from the regressive domain straight to the strategic domain, without institutionalizing all of the new tools, behaviors and capabilities needed to be in that domain. We realized that you can't just look at world class benchmarks and then try to change your organization all at once to mimic the best-in-class organizations. An improvement path must take into account where you are starting from and how you are going to get where you want to go. One important part of this is how we change policies in use.

Focus on Policy

We used a form of scenario planning for those involved in leading the change, that we called "policy workshops" which used a new computer version of the Manufacturing Game™. The key point was to explore for leverage points in the system where we can best intervene, and then formulate action plans to change decision rules and policy, as an aligned team. This was done in the context of another two day workshop, mainly for supervisors, managers, engineers, and key thought leaders in the refinery. We put on five of these workshops in 1996. We found that there was much power in a well communicated policy.

The importance of reaching front line supervisors

We have focused on development and recognition for first line supervisors, and involving them in using positive discipline, an approach we called "MEP" for "Managing Employee Performance." We found that many of our past change programs had not adequately supported or developed our front line supervisors, who in many cases felt not a part of either management or the workers. A number of development opportunities helped, and an action team was created to "improve the lot in life of the front line supervisor."

As the evolution to higher domains progressed, we saw that we needed our supervisors evolving from “chief operators” to “coaches, mentors, designers, and thinking about commercial decisions.” We hoped they could see their vital role in leading action teams as a key competency. In many cases someone already knew sources and root causes of loss--we didn't have to do a big study to learn of many areas needing improvement, nor to generate ideas about what needed to be changed. What it took was an increased ability to listen and then act.

Capacity improvements and variable cost reductions

A surprise finding for us was that a substantial amount of variable cost was saved, not just fixed cost. We'd expected to see Maintenance costs going down, which they did, but didn't realize that many opportunities to save variable cost were easily accessible. Besides the crude oil components that we now can sell as gasoline instead of burning it in the flare, we also saved substantial cost on electricity and on some process chemicals we use.

Pump reliability

Pump reliability, while less rewarding financially, is noteworthy for the emotional results in the plant. Lima Refinery has over 1,100 pumps, whose mean time before failure in 1994 was just 12 months. The unreliability of certain “bad actor” pumps was well known, so any change effort to become proactive would need to address these to be credible.

As is noted in Figure 13 of the main paper, we were able to increase pump MTBF from 12 months to 58.1 months, and saved over 1.5 Million dollars per year in maintenance cost. Another benefit was freeing up time for everyone, as we reduced the number of yearly work orders from over 600 to 131.

Lima Refinery Epilogue

In late 1996 BP announced its decision to close Lima Refinery in 2 years. BP decided to rationalize its refinery portfolio, for strategic reasons. This decision is not in any way connected to nor does it reflect on the quality of the work done over the past three years with learning organization tools and practices. As we have reflected on why/how this has happened we have some insights to apply in our next situations, but no real answers.

Where we are headed now (mid 1997)

The CI forum continues to meet, and is using the same principles and tools to work the issues involved in running the refinery safely and effectively for the last two years of its operation, until closure. In many ways having a culture of continuous improvement, where people take the time to listen to each other and talk together, to really care for each other, has been one key help to maintaining some semblance of good morale in the workforce now.

Conclusions

The path to sustainable change requires increasing personal strength, which then enables us to change our lives and achieve our aspirations. Proactive Manufacturing and the use of the Manufacturing Game™ provided the needed framework for us to do just that.

What all of this boils down to is simple, but hard to do:

- (1) Get the right people together,
- (2) Give them a means to see the big picture (systems thinking)
- (3) Inquire into root causes of dysfunction together as a team (including our own roles in creating and sustaining defensive behaviors and reactive habits)
- (4) allow intrinsic motivation to take over (which means you must evolve to a new theory of governance and devolve control down further into the organization).

We now see that we have the power to change our world, and sustain this change. It is up to us.

As with Dorothy and her friends in the Wizard of Oz, we always had that power, but we didn't know it and didn't use it.

Now we are starting to know it and use it.

End of 1997 abridged paper MC-97-89
Available in its entirety from NPRA or
Paul Monus: 419-226-1218; monuspa@bp.com

Appendix 2:

Abridged excerpts of our 1998 paper
NPRA MC-98-92

Summary of the paper: Proactive Manufacturing

The Proactive Manufacturing process at BP's Lima Ohio Refinery has achieved very rapid improvement rates in plant reliability, cost reduction, production volume increase, and quality improvement. Between 1994 and 1997 \$0.77/bbl on crude were saved by these efforts, with minimal capital expense. This was achieved by engaging the whole organization in the work of defect elimination and proactivity.

These savings came by challenging mental models and developing new decision rules for action and integrating operations with maintenance. The "virtual world" of the Manufacturing Game™ is a "practice field for learning" that engages everyone from hourly craftsmen and plant operators on up to senior management, and has been a key driving force in creating the passion and system wide leverage necessary to achieve the rapid improvement rates achieved.

A new approach to improvement is emerging from this work, which sees the benefits as a consequence of becoming a learning culture, that functions according to very simple rules. Raising awareness and enabling "walking the talk" by new leadership skills and nurturing "chaordic behaviors" is key to the approach.

Performance results since our last paper

Our 1997 presentation to NPRA chronicled rapid improvements in Lima Refinery key performance indicators, but noted that a strategic decision had been made in the company to cease crude processing at the end of 1998. Thus it would be reasonable to have had many of the impressive results from prior years trend in the other direction following this decision.

This is not what happened. Instead, the improvements continued:

- pump MTBF increased
- hydrocarbon loss decreased
- safety improved
- \$0.77/bbl net margin improvement

Hydrocarbon loss

Another example of where creating a learning culture produced financial benefits is hydrocarbon loss. This is a key metric for the refinery that tracks the difference between incoming crude oil and outflow of salable products to customers.

We greatly improved our costs, but also helped the environment = win / win

Lima Refinery Hydrocarbon Loss

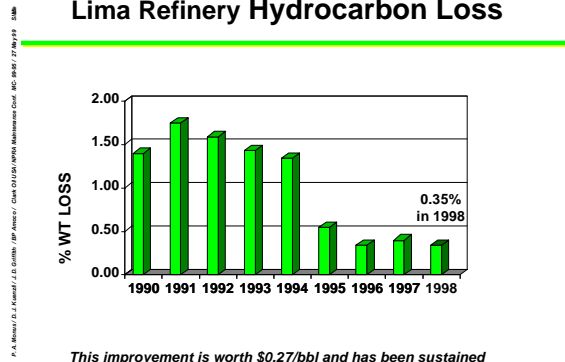


figure 33

Reducing hydrocarbon loss means we retain valuable products eventually are sold rather than flaring them to the atmosphere--a win/win for the company and for society. Figure 33 shows the data. How did we achieve this? Again it was a combination of specialist knowledge combined with the action team approach where everyone became engaged in the effort to reduce losses.

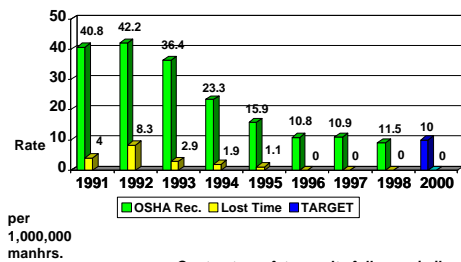
Safety results

Another key area is plant safety and HSE results. These metrics also dramatically improved over three years. See figure 34 for the data on employee safety. Few refineries have done better.

The explanation for these results may involve culture and participation--if we can create a proactive culture of defect elimination the equipment runs better, but it also adds to workplace safety.

Many other actions contributed to improving safety performance not discussed in this paper, but we wanted to note that working for proactivity is very aligned with a strong focus on HSE and safety as well.

Employee Safety Performance



Contractor safety results follow a similar trend

figure 34

Refinery management set and achieved stretch breakthrough targets

Cash Margin Enhancement 1997 vs. 1994

	\$/BBL Crude 95 Basis
Higher Reliability	0.08
Hydrocarbon Loss	0.27
Process Optimization	0.22
Crude Delivery & Quality Costs	0.05
Energy Efficiency	0.06
Cost Savings Initiatives	0.07
TOTAL CASH MARGIN ENHANCEMENTS	0.77

figure 35

Bottom Line Improvement = \$0.77/bbl

Figure 35 shows the impact of these efforts were worth 77 cents per barrel with very little capital investment, largely by using the capacity of our people.

Each of the line items in figure 35 has a story connected to it, not expanded on here. One item not shown in detail (under "process optimization") is process online analyzer reliability, which improved from 75% and not trusted to 97% and trusted.

Evidence is emerging that the analyzer benefit on added value to BP refinery operations is in the region of 10 to 12 cents per barrel—this is due to the benefits of process control and optimization from using accurate real time data to tightly control to commercial specifications vs. "giveaway" of higher value products into lower value streams.

Figure 35 represents the hard metrics that management set for action teams to influence. These are significant in that management did not merely hope that the action team strategy would work, but rather took the step of setting performance goals in very tangible "hard metrics" form and then worked the soft issues to capture the value.

Merging both soft and hard metrics at the same time, as an integrated force, and having the skill to inspire the average person in the refinery to want to join the efforts is required to succeed with the action team strategy.

Planned work

We sought to increase the percent planned work to a breakthrough level of 90% or better, similar to some best examples from the benchmarking studies.

Figure 36 shows how planned work improved. Planned work is defined in this chart as the number of job orders that were not marked either rush or emergency, which must be completed within 48 hours. A corollary to this measure would be number of "surprise jobs" that required pulling off work to pursue a higher priority job. The chart shows a rapid improvement, and also fits with the subjective feeling that the many surprises and changes that had been going on no longer occurred.

We knew planning was a route to efficiency, but didn't focus on it; by eliminating work via action team strategy, emergency and rush jobs decreased from more than 40% to less than 3%

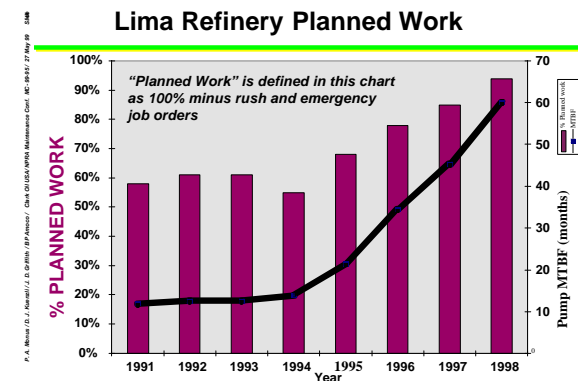


figure 36

Focus on action, not planning

It is interesting that even though we believe in the value of planning as a means to more efficient maintenance work, we did NOT focus on planning.

These results were merely a consequence of having fewer jobs in total to do, which could be planned better using the existing planning and scheduling approach that was in place during the time when the measure was in the 50% to 60% range.

The reasoning for this is that pursuing defect elimination via the action team approach eliminates much of the repeat work. This happens because defect INFLOW is reduced, avoiding putting defects into the system, esp. from Operations.

The traditional approach focuses more on taking defects OUT OF the system once they are in, rather than stopping the inflow by engaging everyone in the system. By eliminating work we had a side effect of being able to do the work that remained with more efficiency, and have a higher percentage planned.

How Did We Do It?

- n Focus on the "BAD ACTORS"
- n Pick some "LOW HANGING FRUIT"
- n "DON'T JUST FIX IT, IMPROVE IT!"

*New organizational structures
Increasing the contributions / involvement of our people*

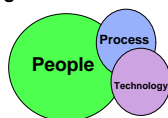


figure 37

To succeed requires building our "people" capacities.

Figure 37 shows that we asked our people to capture low hanging fruit, where without additional capital money we could

- (1) stop doing something dumb
- (2) start doing something we knew we should be doing
- (3) use the knowledge and skills of people in the system about root causes and how to avoid defects getting in.

Much of this was "operational discipline" and did not directly involve the maintenance group. Some of it did involve maintenance and procurement / storehouse, and this cross functional interaction was a place where the learning culture we sought to build had to succeed.

It boils down to getting the best performance from everyone, and everyone being willing and able to contribute.

We evolved our capacity to function as a learning organization and increased its capacity to generate step change breakthrough results. Examples of improvements we will discuss have been in the areas of pump reliability, planned work, hydrocarbon loss, and safety.

A new approach: untapped capacity

The approach to we took to change was not traditional; performance improvements beyond what is typical in a change effort resulted. We did this by

- (1) liberating unused capacity in the people of the refinery (engaging everyone)
- (2) creating new paradigms for integrating operations and maintenance work with the commercial realities of the business
- (3) reflecting systematically about our successes and failures, to learn how to improve going forward.

These results truly came from the skills and experience of our people. A new leadership style emerged. Refinery leaders behaved more like farmers than the captain of the ship, and worked to ensure a healthy leadership ecology throughout the organization. Real leadership emerged from all levels, based on knowledge.

Front line workers evolved their skills, abilities, and awareness to become breakthrough change leaders. Internal networkers moved around BP assets worldwide to learn and share learning.

We started to see both knowledge and leadership as a "phenomena" that emerges within a system that is alive (which is more like an organism than a machine, that you cannot control). The financial benefits generated by these phenomena are the fruit, the consequences of applying practical knowledge

about high leverage points in a very complex and interdependent system.

Evolving this awareness and capacity for effective action was a process, not a one time "aha." Each action team success shed more light on what was required, and the leadership team improvised their next steps based on this evolving understanding of what would be effective.

Building collective awareness, meaning, and then agreement for next actions was a key aspect that enabled team learning. Framing the data in the context of the whole system, with some ability for "systems thinking" also seems to have been important.

The financial results are the consequence of becoming a learning community.

Continuous Improvement Action Teams: focus is not just Maintenance cost

P.A. Monus / D.J. Kuenzli / J.D. Griffith / BP Amoco / NPRA Maintenance Conf. / 27 May 98

- n Weight loss reduction
- n Area pump improvement teams
- n Stop oil to the sewer reduction
- n Process analyzers
- n Propylene Quality to BP Chemicals
- n Jet Fuel Quality
- n Pipeline/shipments coordination improvement
- n Instrumentation and electrical reliability
- n Coordination of shift teams with area teams
- n Facilitation of other action teams
- n Crude oil quality and logistics

figure 38

Figure 38 gives a flavor of some of the action teams. Notice that there are a range of issues we addressed, outside of traditional maintenance department pursuits.

A good example of how the action teams worked is the Butane Action Team Story.

The Butane Action Team Story

Shifting the burden on an operating problem:

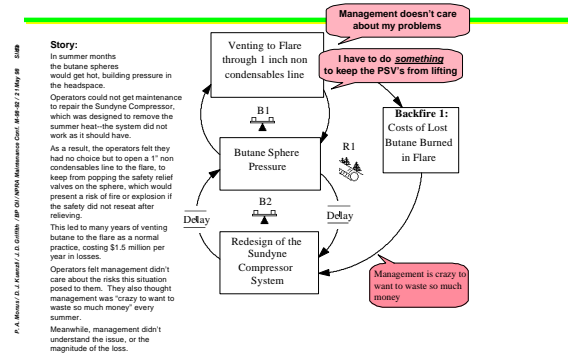


figure 39

The Butane Action Team

For many years the butane storage operated in a quick fix mode during hot summer months. Butane (a blending component in gasoline) has a high vapor pressure and expands when heated, increasing pressure in the storage vessel. The cooling and vapor compression system designed to maintain overhead pressure below the safety valve settings on the vessel was insufficient.

Plant operators would watch the overhead pressure, and when they became concerned that they were too close to the limit, they would open a 1 inch diameter non-condensables line going to the flare header, to vent butane from the spheroid to the flare to reduce the pressure.

During the dialogue at a "Proactive Manufacturing" workshop in March 1995, the operators and management committed to do something about this problem. The team had played the Manufacturing Game™ and had gotten excited about the idea of capturing low hanging fruit and using existing knowledge. Management proposed a theme for the plant operators and mechanics to work on, but they rejected this idea in favor of working on the "butane problem" which the management team had no awareness of.

The story that unfolded suggested that knowledge existed within the company for many years, the operators suggested at least eight years, but probably longer, about the problem. They suggested that "management is crazy to want to waste all this money" by venting butane to the flare (their "quick fix") instead of doing

something (the fundamental solution) to resolve the root cause of the problem. In the past they stated that their supervisors weren't interested in this issue, mainly because they had found a way "to get by" via the venting to the flare fix.

The Butane Action Team Story (continued)

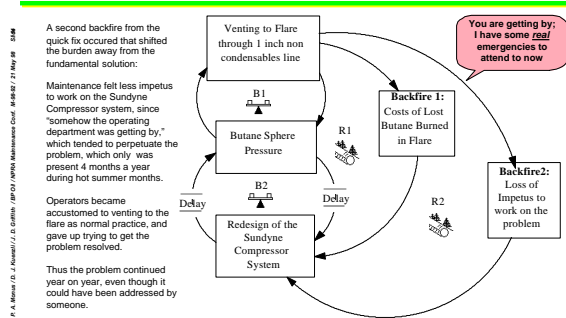


figure 40

A second side effect (see figure 40) of the quick fix was a "backfire" in the sense that the maintenance department no longer felt pressure to resolve the fundamental problem with the compressor; they took the attitude that "you're getting by" and "I've got real crises to attend to" so operators got used to just venting butane to the flare when summer weather arrived.

Something happened in this workshop; honest dialogue took place, some new knowledge was tapped into (the DuPont defect elimination paradigm, and going for low hanging fruit) liberating new willingness and ability to take effective action.

The Butane Story: the intervention

\$5,000 cost, completed in only two weeks time, saving \$1.5 MM / yr

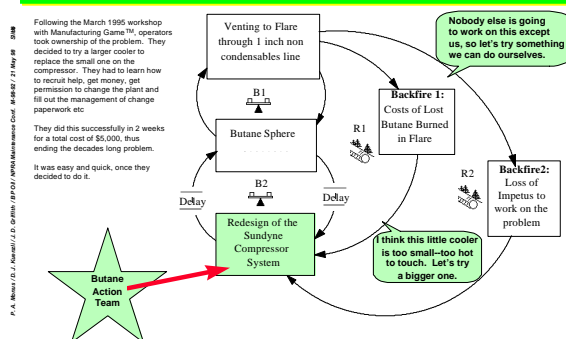


figure 41

The operators knew that the compressor which wasn't working was too hot--you couldn't touch it. They thought that a first step was to cool it down. The existing cooler was the size of a shoe box; the team wanted to find a big cooler to replace it.

The team went driving around the plant looking for a bigger cooler they could use. They found one and had it checked out via the management of change process (involving some supervisors and an engineer). When it was found to be suitable, they had it installed. The new bigger cooler worked; the compressor started working as it was supposed to work, and the overhead pressure in the butane spheroids dropped. The operators were able to eliminate all venting to the flare. For \$5,000 and about 2 weeks of effort by a few people, we now have an improvement in place that saves \$1.5 million per year.

What was amazing was how easy this was, how fast it could be done, how little capital investment it took, and how long this known problem had been in the organization without a cure. We had become addicted to and blinded by the quick fix of venting to the flare, rather than going deeper to find the root cause.

The next question we asked was, if this was so easy, why hadn't we done it before? If people could suddenly take ownership, rather than delegating the problem to management or engineers, what was it that made them do this?

We inquired into this via a "learning history" project. We found five key themes in the learning history, and fact checked these with the original butane action team members. (Our Butane Learning History is available to anyone who is interested; contact the authors).

The CI Forum is a group of managers, engineers, team leaders, and workers who meet regularly to create a space for dialogue about the journey to proactive manufacturing, to reinforce what is going right, and to learn.

About 28 people from the Refinery spent 3 hours discussing what had happened in the Butane Action Team, using the learning history as input data to aid our thinking, and some new insight emerged (some people from the original butane team were in this forum meeting).

After learning and thinking about how to replicate this successful action team, it was decided that the whole refinery should hear the story. The next action was to disseminate the butane learning history to EVERYONE in the refinery in a series of 13 day long workshops, as part of a communication package on progress to date vs. our CI goals.

Management at all levels had to unlearn some things, and develop new capacities, for listening, collectively reflecting and learning, for building aligned approach and execution, and to do all of this without command and control.

Out of control and into order

Dee Hock (founder of VISA) describes this process as "chaordic" and says "out of control and into order." We found it to be exactly so. As mysterious as this sounds, it really isn't.

The CI Forum was "system structure" for *collective* leadership instead of individual leadership, and provided the means for creating shared awareness of current reality, time and space to collectively reflect on events and their meaning, and became the "container" (a safe place) for us learn collectively.

Chaordic leadership

We came to see that some type of leadership forum was needed in order to develop more of this "chaordic" leadership style.

A key principle in this is alignment of everyone to a very few basic rules-getting these right is the key.

Developing the few simple rules (like the "bill of rights" or the "constitution" in the US system of government) allows the "states" or areas / parts of the whole to proceed with real freedom and responsibility, but yet with aligned action and federal awareness and commitment.

This simple type of structure enabled us to delegate much more responsibility to lower levels in the organization for vital business decisions than typical in our plants—some of this is credited to the leadership of the senior team in the refinery, but some of this is also due to the development of a shared mind on the issues, so everyone could take action with the same mental models and goals.

A learning culture

The refinery developed a "learning culture." This includes a willingness to try new things, to change, and to make mistakes and false starts. The key is to learn from these and avoid repeats.

Instead of having "sheet music" for everyone to follow, we were more like a jazz combo, which improvised within a simple structure. The simple rules were a replacement for a "grand strategy" for integrating operations and maintenance.

We never gave up

With the announcement of closure of Lima Refinery in 1996, there was a lot of discouragement and frustration. But the organization did not just give up; instead new possibilities for the site emerged that have now given what was Lima Refinery a new lease on life as a chemicals complex.

After crude cessation (planned for the end of 1998), BP will invest over \$100 million dollars in a new Butanediol (BDO) unit as the first step in a growth strategy that will use the skills and learning capacity of former Lima refinery employees. Lima Chemicals management developed a plan to offer a job to every worker who wanted one, and use the growth of new businesses to replace refinery jobs.

It was projected that the new "Lima Integrated Complex" would employ more people as a Chemical Plant than would have been employed had the refinery not ceased crude processing. [This did not occur, as Clark Oil USA purchased the refinery in August 1998, prior to crude cessation.]

One interesting part of the story is that we made these improvements with an "emergence" approach, based on simple rules, rather than an "order approach" based on control and planning. To succeed, one must tap untapped capacity, residing in the people of the plant. This is a shift towards a "knowledge based" organization (see figure 42).

The shift toward the “KNOWLEDGE--BASED” organization

Task	Resource-Based Organization	Knowledge-Based Organization
Direction setting	Vision from on top	Shared vision
Thinking & executing	Top thinks; local acts	Thinking & acting merged at all levels
Nature of thinking	Atomistic Thinking	Systemic Thinking
Conflict resolution	Political Mediation	Dialogue & building shared mental models
Role of leadership	Make key decisions	Design learning processes

figure 42

Instead of seeing people as resources (like a machine) we sought to capture the full capacity possible by first designing learning processes to engage them with business context and better practices, the nature of our non linear system, and our various differing mental models about these.

Getting this down to the lowest levels was part of the breakthrough, as this liberated a lot of pent up energy and capacity that resulted in breakthroughs, and encouraged real commitment from everyone rather than just compliance.

It wasn't easy, and it was fragile for a long time. Management of the refinery resisted the temptation (which at times grew strong) to impose solutions and approaches, to establish more control, and to opt for quick fixes rather than long term value creation.

We think our ability to resist these temptations to backslide to old thought patterns and behaviors was supported by the belief that the organization is a living organism, rather than a machine.

Going deeper into theory about why this approach was effective

What follows in the paper from this point on is an examination of "why" what we did was effective. Some readers may not find this useful, as the concepts and tools used to articulate our thinking may be unfamiliar.

But we decided to include what follows in the paper because we think it helps increase comprehension of the approach, and for those

who are familiar with systems thinking and the learning organization literature it may be useful to compare our experiences with the theory.

There are two key theory aspects we want to consider: Systems thinking about complex non linear dynamics in a living system, and emergence of order without control.

Interdependencies in a living system

--how can you control this system?

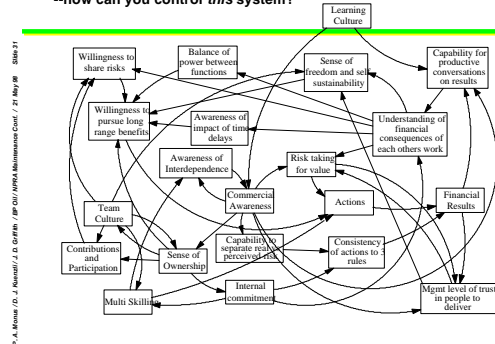


figure 43

Using systems thinking causal loop diagrams we articulated some of the key factors and forces that are involved in our "living system" that have to be operated interdependently to get the payback from the action team strategy (see figure 43).

Without even knowing what each factor is, or what other influences there are for each factor, one can quickly intuit that this is a system that is impossible to predict and control. Soft variables such as "willingness to share risks", "multi-skilling", "sense of freedom and responsibility" and "capability for productive conversations on results" all are fuzzy and hard to measure.

Even though hard to measure, some appreciation of these soft variables needs to be built, so leadership decisions can ensue that actions are helpful to the betterment of the system.

Since each decision is a test of decision rules and new situations require change, capacity to improvise and learn within the boundaries is more art than science.

A living system

Complexity theory suggests that one cannot control a living entity; instead all one can do is perturb it and then notice what the living entity does in response to the input. This isn't a happy recognition, as sometimes the system responds in undesired ways.

This gets back at the importance of the simple rules, and in getting everyone to follow them consistently. The organizational ecosystem is fragile and can easily become damaged; if we depend on the passion and willingness of people as a key driver in the change process, then we must manage and lead in a way that does not impair ongoing and sustained contributions from anyone.

Thinking about passion and how strange an idea this is in an "engineer culture" dominated society like a refinery which seeks and loves order, backup systems, precision, and certainty--one can see why the action team strategy is a perceived risk.

Change is usually experienced as feeling chaotic and disorderly

Understanding how to move in and out of order and live at the boundary

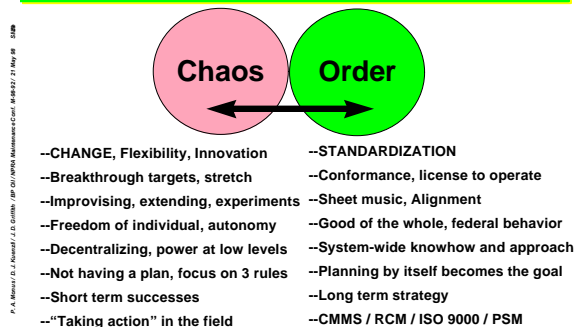


figure 44

No one likes change

If change is needed, and especially if one has to tolerate a loss of control, prediction and order to "unfreeze" our mental models for a while and then refreeze with new improved ideas for the new context, this is experienced by us as feeling chaotic and unpleasant.

We (especially we who are engineers) like order, standardization, conformance, planning, prediction, and control. We argue that this is to maintain our license to operate (management of change processes limit change), and for the good of the whole. It is like sheet music, so

everyone can share the same notes and maintain alignment.

All of this is good.

But to change is to venture into the unknown, be flexible, experiment, risk, and stretch beyond what we know we can do. Improvising, esp. when under pressure or threat, is not comfortable for most people.

The simple rules form a conceptual framework whereby people seemed to be able to evolve a way to take action in the field without the sheet music, and stay pretty much aligned.

Conflicts in approach to change arise from being stuck *only* in order or chaos

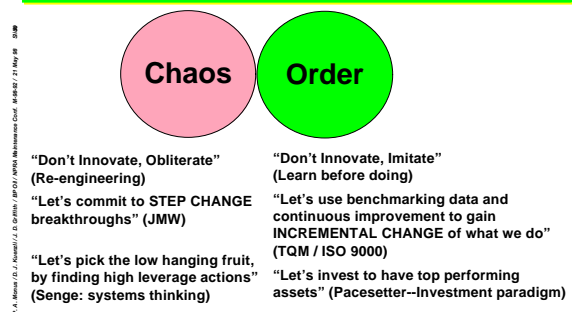


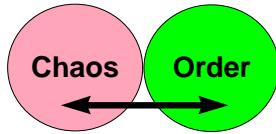
figure 45

Thinking about the need to unfreeze our thinking and then refreeze with innovative approaches suitable to new context explains some of the conflicts we experience with change (figure 45). It also explains the dilemma some feel between whether to pursue incremental change within an existing process or seek to create a step change breakthrough as the focus.

The answer to the dilemma is that it isn't either a step change breakthrough or incremental change for continuous improvement of what already is in existence--it is "both, and."

It isn't "either, or" -- it is "both, and"
This what is involved in nurturing chaordic behaviors

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We need to learn how to live at the interface, the boundary between chaos and order, and move freely in and out of chaos and order.

How to do this?

- NOT by a control and planning paradigm
- more by improvising in the moment, by owners of the change

figure 46

Living at the boundary

Dee Hock describes this ability to effectively and safely migrate from order into "chaos" and then refreeze with order again as a "chaordic" process--having the characteristics of both order and chaos at the same time, like living at the boundary.

This capacity to live at the boundary and nurture chaordic behaviors is a deep subject that still is pretty mysterious. What is clear is that one does not succeed by a control and planning paradigm. More likely, one succeeds by improvising, within some boundaries given by very simple rules (like in figure 12), by people who behave as true owners of the system and the change.

The strong desire for order and maintaining control explains our willingness to see the benefits of RCM, CMMS, and ISO 9000 or other organizational discipline processes, and have trouble believing that the action team strategy can work.

One lesson from our experience is to need for urgency—to start the journey to proactive behaviors and results ourselves before others have to impose change on us. Often "solutions" imposed by others don't work, and are merely quick fixes that don't address fundamental issues..

Focus on fundamental solutions

We must focus on fundamental solutions, not quick fixes. To do this means we have to learn new ways of thinking and behaving, and adapt to change in a very fast and flexible way. No one else can do this for us, we have to do it for ourselves.

Conclusion: There is no cavalry-- we only have ourselves

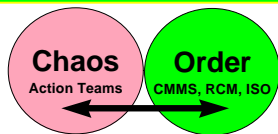
- n To reach the proactive way of working we must focus on fundamental solutions, not quick fixes
- n To change the way we work, we must change ourselves
 - paradigm shifts in our thinking
 - new decision rules and policies
 - new behaviors
- n The quality of relationships between people and our willingness and ability to learn are keys to success
- n We must develop the capacity to create the future we want
 - no one else will do this for us

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figure 48

The action team strategy vs. the planned strategy

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- | | |
|--|--|
| <ul style="list-style-type: none"> --In reactive domain, I don't have the time to do planned domain work first --The focus is on eliminating work, stopping the inflow of defects (action focus) --Use what I already know (root cause) rather than a lot of paperwork / study --I have to give up control --Trust people to do what is right | <ul style="list-style-type: none"> --Take the time to prepare for the future when the data will be needed --Data (lots of it) is required; include all the data, not sure which will be important (data focus) --Study failure modes of critical equipment / RCM discipline --Maintain control: Design process and systems to "force" the troops to do the right things; cannot trust the troops |
|--|--|

figure 47

The quality of our relationships

Since we are a living system, we must focus on the quality of relationships and how we treat each other as key success factors. Learning how to nurture chaordic behaviors is a key leadership competency required to enhance our capacity to create the future we want.

The journey evokes meaningful work, higher morale for everyone, better decisions and actions. Everyone starts thinking and acting like an owner. But management must open themselves to the ongoing participation and shared leadership emerging from every level in the organization.

Spread of the Manufacturing Game™

These ideas are spreading throughout BP Amoco. See figure 49 for the list of assets who have adopted these ideas; over 2,000 people have participated (voluntarily) in these workshops.

Spread of the *Manufacturing Game*TM “action team approach” within BP Amoco

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- n Lima Chemicals 2/94 *
- n Lima Refinery 5/94 *
- n Toledo Refinery 7/94
- n Prudhoe Bay 1/95
- n Magnus 3/95
- n Alyeska Pipeline 1/96
- n Kwinana Refinery 8/96 *
- n Forties 7/97 *
- n Wytch Farm 7/97 *
- n Coryton Refinery 3/98 *
- n Grangemouth Refinery 10/98*
- n Nerefco Refinery 2/99*
- n Decatur 4/99*
- n Bayernoil 5/99*

** internal facilitators now trained (or in training) on-site, co-delivering the workshop and supporting / facilitating action teams, and providing network leadership to line managers and to executive leaders on the journey*

- To date, over 2000 people in BP have experienced a two day hands on organizational learning workshop with Mfg. Game

figure 49

Conclusions

In the turbulent times we are in now and likely to see in the future, taking action before we are forced by crisis to do so is wise. There are many reasons to begin an ongoing process of continuous evolution in the way we think and work.

end of 1998 paper abridged paper
NPRA MC98-92

For the full version contact NPRA or
Paul Monus: 419-226-1218
monuspa@bp.com

James D. Griffith (Jim)



***Manufacturing Manager
BP Amoco Chemicals
Green Lake, Texas***

Jim began his career with Standard Oil at Toledo Refinery in 1974 following his graduation from the University of Cincinnati with a BS Degree in Electrical Engineering. His earliest assignments were in refinery control systems, maintenance and operations. He served as Maintenance Superintendent and Superintendent for Oil Movement and Storage at Toledo before becoming Manager of Maintenance and Engineering at BP's refinery in Gothenburg, Sweden in 1988.

Upon his return to the states in 1991 he was the Manager of Commercial Operations for the Northeast Region of BP OUS. In 1994 Jim was named to the Ohio System Team as Manager of Plant Availability for the Lima site. He is now serving as Manufacturing Manager for the BP Chemicals Acrylonitrile facility at Green Lake, Texas. Jim is married to wife, Karen, and has three children ages 24, 20 and 8.

Donovan J. Kuenzli (Don)



***Refinery General Manager
Clark Oil USA
Port Arthur, Texas***

Don began his career at BP Chemicals, Lima, in 1965 where he held various operational and technical positions, including Nitriles Plant Manager. In 1984 he became Plant Manager at BP's Green Lake, Texas facility. He joined BP Oil's Refining Department in 1987 as Operations Manager at the company's Alliance Refinery. In July 1990, Don began an international assignment as Business Technology Manager in the M&S Business Development Unit in London and later as Manager of the Technology Development Unit. Don earned a BS Degree in Chemical Engineering from Ohio University and completed the Tuck Executive Program at Dartmouth College. He returned to Lima in June 1993 as Site Manager and became Refinery Manager in November 1996. He served in this capacity until the Refinery was sold to Clark Oil USA in August 1998, when he was named as Refinery General Manager for Clark Oil USA's Port Arthur Texas Refinery.

Paul A. Monus



Senior Project Manager BP Amoco Chemicals Lima, Ohio

Paul Monus is Senior Project Manager, currently developing and implementing learning organization, system dynamics, and knowledge management processes for BP Amoco worldwide.

As part of the Pacesetter facilitators network, Paul has spent the past 2 years working mostly in BP Oil and BP Exploration delivering Manufacturing Game and systems thinking workshops. Paul functions as an internal consultant-- training / coaching local site leaders and their management teams, designs program rollouts, and brings the ideas of the learning organization into practical use.

Paul's prior experience includes Manufacturing Manager, Process Technology Manager, and Area Superintendent roles for Barex, and the Area Superintendent role for Catalyst, HCN, Acetonitrile, Loading/Shipping at Nitriles. He was also Senior Technical Specialist for the Acrylonitrile process, and designed and started up Barex plants in Japan and Switzerland.

Paul has a degree in Chemical Engineering from University of Minnesota. Current interests include skiing, tennis, and the nature of leadership in a learning organization.