"Sharing Information to Improve Reliability"

TMG News

The Manufacturing Game®

April 15, 2013

Dueling Defect Elimination Approaches

From TMG News July 2003

Just recently a client asked us why they need cross functional action teams to eliminate defects when they have Six Sigma or RCM teams. We remembered an article that originally ran in the TMG News, July 2003 edition. As new concepts come to light some things just don't seem to change. Below is that article along with an update by one of our licensees, Andrew Fraser from Reliable Manufacturing in the UK.

One advantage of our dynamic benchmarking approach is the ability to conduct what-if analysis on best practices. One of the best practices that we have recommended for some time is the use of many small, cross-functional action teams made up of hourly operators and maintenance personnel. For those familiar with TPM these would be called Equipment Improvement Teams. This approach to defect elimination is very bottom-up. Teams pick their own defects to pursue; there is no formal facilitation of the team and no embedded expertise from management or engineering. The more traditional approach to defect elimination would be top-down. The two most popular versions of this approach today are Reliability Centered Maintenance (RCM) and Six Sigma programs. The top-down approach ensures that teams are focused on the most important defects, have a very rigorous process and are heavily facilitated by managers and engineers. These approaches each have distinct benefits and pitfalls that we have known about for some time but did not have a way of quantifying or comparing…until now. Let's get ready to rumble!

In this corner – bottom-up defect elimination

In the dynamic benchmarking simulation, bottom-up teams have the following features. The number of teams that we target is two teams for every site employee per year. That translates to teams equal to 40% of the site population assuming our standard five person teams. A site with 1,000 employees would have 400 teams a year. Wow! What a huge number. This volume of participation is, as we will demonstrate, the great strength of this approach. Each team targets a small defect that they can eliminate in 90 days or less. They spend on average about $2,000 and expend on average 60 person hours eliminating the defect. Based on client data we know that only about 50-70% of those teams will be successful; in the simulation run for this article we used 55%. The low yield has to do with motivational problems that a bottom-up approach cannot overcome since it does not have heavy facilitation and encounters organization impediments that cannot be overcome by hourly workers. The low yield is one of

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Purge Point Fittings

Our Action Team story in this issue comes from SABIC's Ethylene Liquefaction plant in the UK. The "Bug" that the Action Team chose to work on affected the whole ethylene team when preparing equipment for maintenance. Nitrogen is used to purge the process fluids from the equipment before it can be handed over to maintenance. This is achieved by removing a blank flange and fitting a purge point connection to a plant Nitrogen hose.

Previously there was no structure in place to store these fittings... They were not individually identified which meant the technicians often had to source and carry several fittings to the plant to find the correct size. This often resulted in delays in equipment preparation.

A well balanced Bug team was set up to address this frustration –a Lead Technician, a Fitter and an Assistant Plant Manager made up the team. The bug fix was to uniquely identify the purge fittings to the equipment they fitted and build up a database to ensure sustainability of the fix. Following a plant survey, new

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What's Inside?

SCHEDULE

**Throughout the year,
The Manufacturing Game® holds workshops for the general public at universities and/or professional organizations.
For more information visit**
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Conferences of Interest

Reliability & Maintenance Conference
Orlando World Center Marriot
May 21–24, 2013
For more information or to register visit:
www.afpm.org
Visit The Manufacturing Game®
at Booth #1100

System Dynamics Conference
Cambridge, MA
July 21–25, 2013
For more information or to register visit:
http://conference.systemdynamics.org/

Houston Chapter of SMRP Maintenance and Reliability Symposium
Moody Gardens Galveston, TX
August 15–16, 2013
Golf Tournament August 14, 2013
For more information or to register visit:
www.smrphouston.org
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Mark Your Calendar!

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the down sides of the bottom-up approach. We also know that an even smaller fraction will not only eliminate a defect but also eliminate the source of that defect (e.g. replace a faulty impeller –defect eliminated versus replace a faulty impeller and change the specifications in purchasing – defect and source eliminated.) Of the successful teams only forty percent will get at the source.

And the challenger – top-down defect elimination

Top-down defect elimination gets a much higher yield. The literature would suggest an almost 100% success rate. Our experience suggests that there are multiple opportunities to fail in a top-down effort, but we will give this approach the benefit of the doubt and say that less than ten percent of teams fail due to lack of motivation, poor idea generation or lack of management support. So a ninety-one percent yield rate versus the bottom-up yield of fifty-five percent. Top-down efforts also benefit from bigger impact because they tend to systematically go after the big defects. Based on published results of bottom-up teams the average savings is $25,000 per team. Published results from Six Sigma efforts suggest a $250,000 savings per team. The impact of a successful top-down team is ten times a bottom-up one both in terms of defects eliminated and sources eliminated. So, a doubling of the yield and a ten times factor on impact per team would lead you to believe that the top-down approach is all but invincible. But let's examine the short-comings. To extend the boxing analogy, the top-down approach packs a lot of punch but it lacks reach. RCM analysis, due to their time consuming nature and high cost, are slow and can only be justified on critical equipment. Six Sigma requires trained Black Belts to sponsor and facilitate projects. If you take the recommendations from the Six Sigma literature, you would have one facilitator for every 100 employees who each conducted 3-5 projects a year. In our fictitious 1,000 person site, that would mean about forty projects in a year. Forty RCMs in a year would be a large number as well. But that is still a far cry from the 400 bottom-up teams. At best, in a year, forty percent of the plant would be involved and our experience suggests it would be much lower since many of the same people tend to be involved in these projects.

Squaring off

The top-down approach looks good in the early rounds of the simulation. Teams are knocking out significant defects and rooting out the source of those defects. Almost every team is successful and they all make a significant contribution. But ultimately the short reach is its undoing versus the lower yield but longer reach bottom-up approach. The hourly action teams are far less likely to be completed successfully and even when they are, yield only 1/10th the benefit, but they involve everyone. To understand the impact of this you need to understand the nature of ownership. Ownership is defined as an employee's willingness to get involved in and initiate improvements. We measure it on a 0-5 scale with a zero meaning that most people will actively resist improvement efforts and a five meaning that most people will initiate improvements without management prompting. The plant in the simulation is at an ownership level of two, which is pretty typical for the plants that we work with. This means that most people will go along with improvement efforts if asked but are unlikely to initiate them. From previous articles, you should already know the power of raising ownership. Increasing ownership creates self-generating

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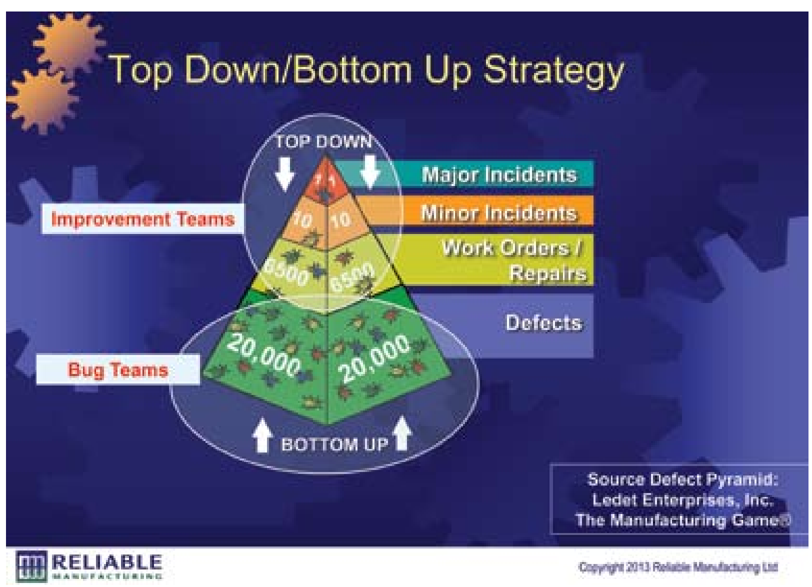
improvements, a desire to find root causes and improved productivity. A move from 2–5 in ownership at this plant is worth almost $150 million over three years. The best way to build ownership is to give people a chance to have an impact and let them see their results. Most people will be hungry for more when they get that opportunity. But ownership declines over time if not fed. If you involve me today and get me excited but then don't give me another opportunity for several years, the ownership that I gain slowly diminishes. This is where the reach problem hurts top-down efforts. As we mentioned, at the very best, the top-down approach impacts the ownership of 40% of the personnel in a year compared to 100%+ in the bottom-up approach (two teams each person with a 55% yield). When the ownership advantage kicks in and people start generating their own improvements, finding root causes and working smarter, the bottom-up approach takes the lead and never gives it up. Stated another way, the bottom-up approach is a much more effective way of changing a culture even if it is not quite as effective at eliminating specific defects. This is shown even more dramatically if you turn off both programs after the first three years and run an additional three years. The bottom-up scenario continues to improve due to the imbedded culture change reflected in the ownership level while the top-down approach slowly decays as the outside stimulus of teams is removed and ownership begins to decline.

Post-fight wrap up

Western culture favors the top-down approach because we love the control that it implies and because of the apparent advantages in terms of yield. We fail to see the shortcomings of the reach. It would be a mistake to read this article as an indictment of either RCM or Six Sigma. We believe and our dynamic benchmarking shows both to be highly effective defect elimination approaches. In fact, once ownership reaches a four on our scale, where many employees are willing to initiate improvements, the top-down approach is preferable to the bottom-up. To quote Jack Welch, "You couldn't have Six Sigma without Workout. You couldn't put Six Sigma in a bureaucratic company doing bureaucratic things. It would just have sunk it." Our argument is that they lack reach and in many cases fail to build the ownership necessary to make a dramatic and lasting change. If you are using either approach or a similar approach, the lesson from this article is to look for ways to extend the reach. Involve more people in the implementation. One client we work with takes the recommendations from an RCM as the starting point for action teams. Have a simplified process for smaller problems. Use the top-down process for the big defects and have some form of bottom-up approach for the small ones. In any case, track your ownership and make sure that your program is moving the needle on this critical measure.

2013 Update

A licensee of The Manufacturing Game®, Andrew Fraser – Reliable Manufacturing, who conducts workshops in the UK, Europe, the Middle East, etc. made a significant addition to the defect pyramid that we have used over the years. We think it is a great depiction of why and how defect elimination of small random defects should be coupled with existing major projects that eliminate the big defects. We hope that the significance of this diagram will be helpful to organizations in realizing that each method has merit but both are needed in the long run since they attack different spectrums of defects. However, the top down approach tends to be reactive (eliminating bugs that have already caused losses) whereas the bottom up is more proactive (eliminating bugs before they cause losses).



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fittings were sourced and painted to aid in identification and given a unique identification number for the equipment that they fitted. A database key was added to the storage cabinet door to identify which pieces of equipment the purge points fitted.

This allows the technicians to quickly and easily find, identify and fit purge points to plant equipment which has speeded up the preparation and hand back process associated with preparing equipment for maintenance.

The bug fix will be further enhanced in the future with the painting and numbering of the

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7702 FM 1960 East, Ste. 226
Humble, TX 77346
(281) 812-4148
(281) 812-4149 Fax
http://www.ManufacturingGame.com
email: *info@ManufacturingGame.com*

"Opportunity is missed by most people because it is dressed in overalls and looks like work."
~ Thomas A. Edison

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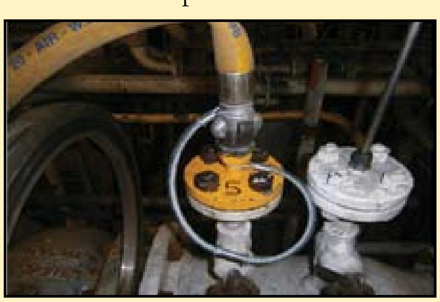
actual blank flanges on the plant to aid identification.

The elimination of this bug was inexpensive to complete, requiring only a few new fittings, painting them and adding the numbering. It has proven to be an excellent example of how a cross functional bug team can easily eliminate a long standing issue and simultaneously provide benefits to both the business and the people doing the work.



N2 fittings database

Equipment	ID	Size
2A/2B Plants		
N651J	5	1" 300
N601J	5	1" 300
N650J	5	1" 300
2A link	5	1" 300/600
2B link	2	½" 600
609J'J/A	4	1 " 150
600J'J/A	5	1 " 300/600
No 3 Plant		
N675J/A	1	½" 150
No3 link	5	1" 600
N677J/J/A	3	¾" 600
No 4 Plant		
N5900J	6	1 ½ "150
N5901J	4	1" 150
No4 Link	2	½" 600
Propylene storage		
N920J J/JA	4	1" 150
N921J/JA	7	1 ½ "300
N925 J/JA	7	1 ½ 300

This Action Team story was sent to us by Andrew Fraser from Reliable Manufacturing in the UK. Andrew has been working with SABIC using The Manufacturing Game® as part of a Manufacturing Excellence Program. You may contact Andrew via email at: andrew.fraser@reliable-manufacturing.com.