TMG News

The Manufacturing Game®

January 15, 2009

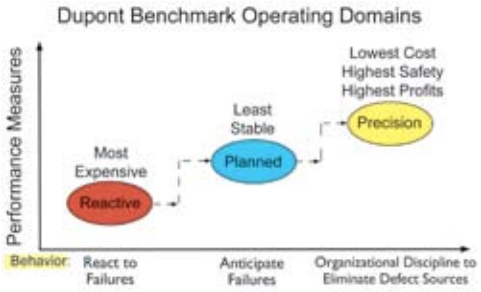
"Sharing Information to Improve Reliability"

Measuring Empowerment of the Workforce Through Socio-Technical Network Theory

By Winston P. Ledet

The basic job of the people in a capital intensive manufacturing organization is to tend to the machines that produce the product. How can we empower people to do that? One person alone cannot accomplish this job. Organizations that have been successful have found ways to empower their workers to provide the proper care for the equipment. A means for measuring this empowerment uses the socio-technical network theory.

In the 1990's, DuPont conducted an extensive benchmark of maintenance best practices resulting in the discovery that most production facilities operate in one of three Stable Domains – Reactive, Planned or Precision.



A System Dynamics model of this benchmark data was created to determine the basic structures that create the Stable Domains. The key to answering this question was to model how defects are created and the consequences of having defects in the equipment portion of the socio-technical networks. It is known, and has been the focus for most of the improvement efforts in manufacturing over the last 50 years, that defects are the targets of TPM, TQM, RCM, Six Sigma, etc. The conclusion is that defects are the root cause of all failures and therefore the focal point of all improvement programs.

It is the behavior of people that determines which domain a site will occupy. In the Reactive Domain, people just react to failure events as they occur. In the Planned Domain, people try to anticipate failures and take action to correct it before the failure occurs. In the Precision Domain people find the sources that create the defects in the first place and eliminate those sources. We learned from the community of people working on organizational learning that Structure creates Behavior which creates Performance. In his book, The Fifth Discipline, Peter Senge states that, "Structure in Human Systems means the basic interrelationships that control behavior. This includes how people make decisions, the 'operating policies' whereby they translate perceptions, goals, rules, and norms into actions. In human systems, people often have potential leverage that they do not exercise because they focus only on their own decisions and ignore how their decisions affect others." In production facilities we need

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A "Feel Good" Challenge

Gary (Flap) Legendre, Cy Case, Jesse Stelly, Kelly Molliere and Mark Lake formed a cross functional Action Team after a Manufacturing Game workshop in October of 2007. The team from Georgia-Gulf in Plaquemine, LA was compelled to standardize the blinding scope for a furnace decoke and quench column system maintenance procedure. For each decoke the assigned operations shift would develop a new blinding plan. This involved a great deal of wasted man-hours and often confusion on the part of those lacking experience with this equipment.

Flap said, "If it was done to a specific standard the first time you would not have to go back and do it again." Normally it took an eight-man crew two to four hours to perform the blinding procedure. The team discussed the situation and Cy came up with the idea of a detailed diagram with all the information for everyone to follow. This encouraged maintenance and operations to work together to define the equipment that would be involved in a decoke. They developed standard steps required to perform blinding on the equipment included in the scope. Finally they developed a blinding/isolation sheet, (included drawings of the equipment) to document blind locations for equipment isolation, bolting/gasketing and tool requirements. Everyone would know exactly where the blinds were or where they were to be placed. Flap also came up with the tool specifications stating which tools and what size to use. It was no

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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.
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The Manufacturing Game® will be holding a FREE Public Workshop at the EAM/RCM Conference in Daytona Beach March 24, 2009.
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Seating is limited so sign up early!

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EAM Mastering Enterprise Asset Management
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Reliability Centered Maintenance Managers' Forum & Enterprise Asset Management Summit
Daytona Beach, FL
March 23–26, 2009
For more information or to register visit www.MaintenanceConference.com or call (888) 575-1245

NPRA

NPRA Reliability & Maintenance Conference
Grapevine, TX
May 19–22, 2009
For more information or to register visit: www.npra.org/meetings/maintenance.com

Mark Your Calendar!

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to add in the equipment which determines some limits on human behavior. This creates a socio-technical network as the structure of production facilities. If we want to improve the performance of an organization, we have to create the new structure of the organization to match the domain we wish to obtain.

What Creates Structure?

New structure is created by actions taken by people in the organization to pursue new values. Actions include three levels of the 'acts of will':

- Attention – what do people focus on?
- Choices – given a set of options, how is one chosen?
- Decisions – how are new options created?

Structure is also created by changes in the equipment through age, use, replacement, expansion, storms, etc. Specifically, the structures of organizations in each domain are:

The Reactive Domain, where people wait for an event to happen and then react. The relationships of people in this domain are directed at functional excellence. Since failure events can damage the equipment in unexpected ways, it is very important that the people who repair the equipment have high skills in repairing and replacing equipment in a very efficient manner. Therefore, most organizations assign their people into functional silos to create the high level of skill necessary to cope with the wide variety of failure events.

In the Planned Domain, people observe the patterns of behavior and create strategies to anticipate events and prepare to take action before the event happens. The focus is on predicting the potential failure events and taking action to prepare for the possibility of failure and to execute the plan before the failure event occurs. In this domain, two things are better. First, you avoid the collateral damage that can happen in the failure event itself and second, you can be much more efficient in the use of the resources for repair by scheduling the work at a pace that allows for the proper use of those resources.

In the Precision Domain, people recognize that defects are the structural reason for the failure events and take action to eliminate the sources of defects. In this domain, the focus is on finding the sources of defects and eliminating those sources so the possibility of a failure event is eliminated all together.

In 27 years at DuPont, attempts to implement the best practices recommended to achieve the Planned Domain resulted in at least seven successful attempts only to slide back to Reactive in a few years. In fact, as a member of the DuPont Corporate Maintenance Leadership team, we were able to sustain performance in the Planned Domain for 10 years. However, when the corporate leadership team was dissolved, the slide back to the Reactive Domain began immediately. Since the Planned Domain is so unstable, we need to concentrate on how to go from the Reactive Domain straight to the Precision Domain. It is important to explore how empowered workers can drastically improve the performance of an organization and how to measure empowerment. The most significant discovery made in the DuPont benchmark was the power of cross-functional teams found in Japanese plants. People agree that you get things done in a large organization through the connections that you have with other people. Research in the 1970's showed that the connections that count in these large organizations are the ones that are directly connected to the work itself. There are tools today to measure the degree of connectivity within an organization. Using these tools we

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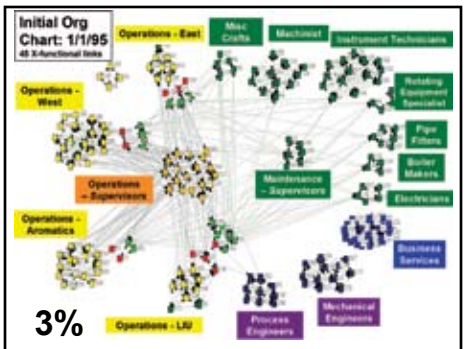
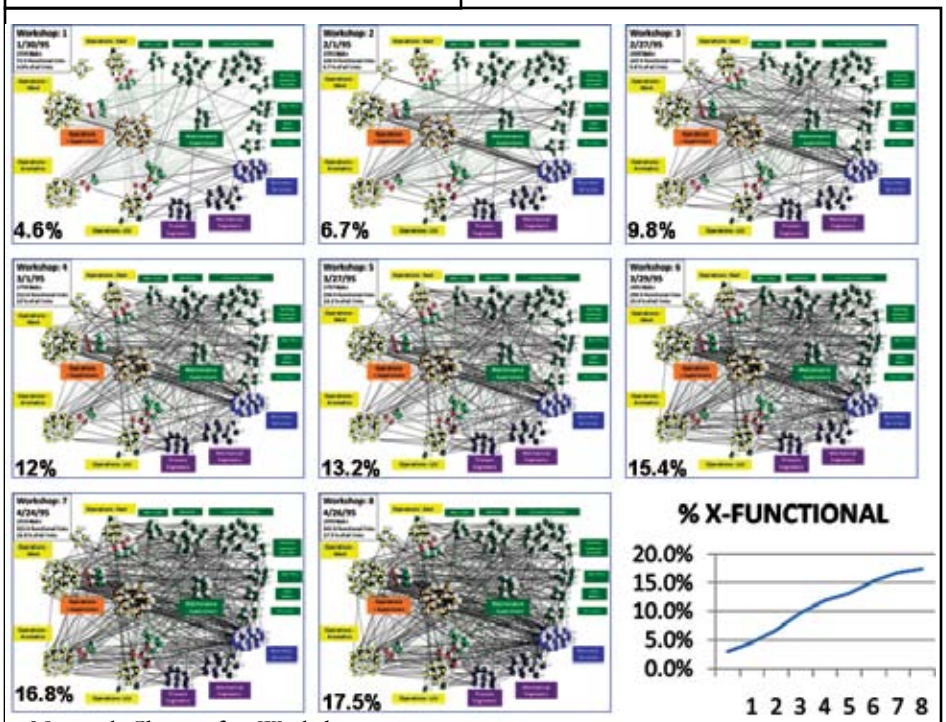
have been able to depict the strong effect cross functional teams have in creating these networks.

At one of the sites we worked with, the Proactive Manufacturing Program created cross-functional Action Teams as a means to search out the sources of defects and eliminate them. The experience of participating on an Action Team created rather strong bonds between the people on that team. There is something about being part of a team, working together to solve a problem, that makes the contacts formed in that team very meaningful. We tracked these connections to depict the change in the network of the organization that was informally created as a result. Two hundred twenty-five people each participated in one of eight workshops and joined an Action Team to eliminate the source of a particular defect that they chose. The eight workshops were conducted over a three month period. Note on the chart the percent of links that are cross-functional increased from 3% to 17.5%. Everyone in the organization had at least one connection to another function and on average each had 1.5 such connections. Now information flow could go through all of the nodes to other functions. This increased the power of each individual to get things done through other people. Thus all of the people were empowered to get things done in the organization.



Inital Network Chart



Network Charts after Workshops

Chris Argyris, a Harvard professor who has studied organizational change efforts for many years says that Empowerment requires internal commitment by the employees. The Proactive Manufacturing initiative at the Lima refinery did in fact create this internal commitment in the vast majority of employees. In our System Dynamics model of the DuPont benchmark data, the most impactful variable is one we named "ownership" which we equated to internal commitment. The level of ownership determines whether the change program succeeds or not. The design principles of the Action Teams at the Lima refinery paralleled the advice of Argyris. Erich Jantsch in his book "Design for Evolution" states that people do not feel responsible for their behavior, but they do feel responsible for their actions. He says that behavior is just reaction to a situation whereas action is the creator of the situation and therefore the responsibility of the person initiating the action. Jantsch goes on to state that culture change is accomplished by actions of people and then the culture, as the new structure, insures that the behavior will be sustained. The change at the Lima refinery is still going on after 14 years and has increased the value of that site as well as creating a happy and productive work environment.

FINDING A BRIGHT SPOT in the ominous task known variously these days as "rightsizing" or "workplace reengineering" isn't easy. But one consultant brought in to help remaining managers through the process of reducing the workforce while maintaining productivity added a contemporary twist to the old classic "What does the optimist say about the glass and the water?" he asked. "It's half full," was the reply "And what does the pessimist say?" he queried "It's half empty." "And what does the process reengineer have to say about it?" Silence—until the consultant revealed the new additional answer: "Looks like you've got twice as much glass as you need there."

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The benefit of each New Year is that it provides us with a clean slate to begin anew. However, rather than forget our mistakes of the past year, let's learn a thing or two from the experience and resolve to make only new mistakes in 2009.
–Anonymous

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longer necessary to look up what tool to use each time.

In order to develop the blinding/isolation sheet Jesse taught himself to use Visio drawing software, then he and other members of the team went to each shift and explained how to do the procedure. Kelly documented the plan in MARCAM for scheduling and planning. This ensured that no matter who was assigned the task, the work would be done consistently.

The team helped operations and maintenance reduce downtime, scheduled overtime, and maintenance costs. The team found defect elimination a challenge. A challenge that made them feel good about solving one of those nagging problems. They felt that not only was The Manufacturing Game Workshop enjoyable, but more importantly helped improve their work skills. Flap noted, "If you can get something done and it works, do it."

Doing Away With Exceptions

Maintaining the water chemistry in the cooling tower is very important for a variety of reasons. It minimizes the growth of organisms such as algae and also minimizes corrosion. Both problems can also extend to the heat exchangers and cause production losses. Cara Barron (Engineer) and Ray Garcia (Operator) brought in Ernie Huber and David Deblanc from Chemtec (the company that supplies the chemicals for the cooling towers) to join their Action Team and find out why cooling tower PS2 was having almost daily exceptions for 3–4 months. Because of the problem operators had to go from taking one sample per day to taking a sample every 3 or 4 hours. Each of these samples takes 30 to 40 minutes, amounting to 2 ½ extra hours per day or 250 man-hours of the operator's time in a 4 month period.

The team decided that the injection pump that pumps the chemical PO_4 into the cooling tower to treat the water was not functioning. They first tried to clean the strainer on the PO_4 pump suction, and then, decided to go with a larger filter. Since that didn't solve the entire problem they looked further and found that the tank contained too much sediment that was plugging up the strainer. They cleaned the tank and filled it with fresh PO_4. They pump was now pumping, but the breaker kept tripping. Whenever the plug to the breaker box got water or moisture build up it would trip the breaker. By caulking where the moisture was getting into the plug they were able to moisture proof it, and now the injection pump is running fine.

Through this process the team learned that "You can get a lot accomplished when you get different resources to work together as a team." This is a situation where bringing a vendor in to be part of a cross functional action team can be beneficial because they can provide additional knowledge and insight into the problem.