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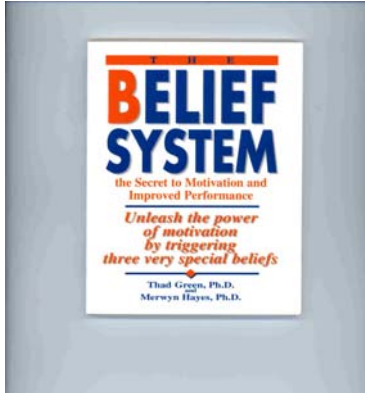
Automotive Suppliers: Use 3B Cause and Effect Analysis for Employee Performance Problems

A Quantitative Method for Eliminating Waste and Reducing Cost Due to Underutilization of People

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OEM's can be some of the most demanding customers in the world. Two common demands are *no recurring problems* – not making the same mistake twice - and *elimination of non-value added activities*. Various continuous improvement or *kaizen*¹ activities are used by automotive suppliers to meet these two OEM demands. This paper explains how 3B Analysis, a new technique, exclusively available from The Hayes Group International, can be used to help automotive suppliers better meet these two demands.

The History of 3B Analysis



3B Analysis was derived from the original research and theories of Yale University researcher and writer, Victor Vroom in the 1970's. Later Thad Green developed a practical application model of Vroom's work called The Belief System that was first used at AT&T. This application model was captured and further defined in the book, *The Belief System – the Secret to Motivation and Improved Performance*, authored by Thad Green and Merwyn Hayes.

Understanding 3B Analysis – The Chain of Beliefs

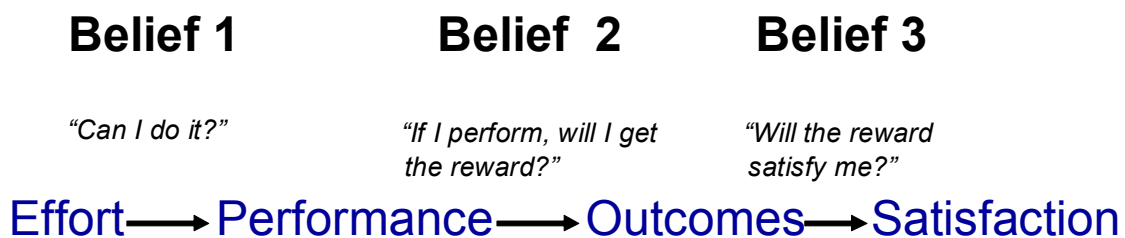
The Chain of Beliefs determines how hard people will work and how well they will perform in given situations (see *Fig. 1*). This chain of events proceeds as follows: Effort leads to Performance which leads to Outcomes which results in Satisfaction (or dissatisfaction). Traditional methods of motivation focus on the last event – offer an Outcome that employees want and they will work hard to get it. These traditional methods ignore a key process within each employee – an employee must first *believe* certain specific things before the offering of desirable outcomes produces the high employee performance that managers expect. These three beliefs are the cornerstone of 3B Analysis.

What are these three beliefs?

- Belief 1 is Confidence. *Can I do it?*
- Belief 2 is Trust. *Will Outcomes (Rewards) be tied to my job performance?*
- Belief 3 is Satisfaction. *Will Outcomes (Rewards) be satisfying (or dissatisfying) to me?*

If all three of these beliefs are strong, employee *effort* and *performance* will be high. However, if one or more of these beliefs is low, employee effort and performance will be low.

The Chain of Beliefs



Traditional motivation methods focus on **Satisfaction**: Offer employees what they want (or don't want) and they will work hard to get it (or not get it), but ignore the critical first parts of the Chain of Beliefs – **Effort** and **Performance**

Fig. 1

Before continuing, clarification of key terms will be helpful. The following terms are used by various OEM's and automotive suppliers to describe nearly the same thing. However, we will use the **bolded** terms in this paper.

- **Root cause** and cause
- **Solution**, countermeasure, and permanent corrective action
- "Going to the floor", "Management by Walking Around", and **Going to Gemba²**

Before we explore how 3B Analysis can help an automotive supplier, let's look at how automotive suppliers wrestle with the two OEM demands described in the first paragraph of this white paper: Prevention of recurring problems and elimination of non-value added activities.

Cause and Effect Problem Solving to Prevent Recurring Problems

The only thing worse than making a mistake, is making the same mistake twice. In the 1980's, American OEMs' concerns with recurring quality problems led to formal problem solving cause and effect methodologies such as TOPS (Team Oriented Problem Solving), and the Global 8D (The 8 Disciplines³). Automotive Suppliers were expected by the OEM's to train their managers, engineers and other employees on the use of these methodologies and to use these methodologies for solving problems by assembling cross-functional 8D teams.

An example of the steps to an 8D problem solving process, currently in use by Daimler Chrysler, is found in *Fig. 2* below. Although the 8D steps of the various OEM's vary somewhat, their centerpieces are determination of root causes and establishment of solutions, permanent corrective actions or countermeasures.

Daimler Chrysler Prism Corrective Action Process

1. Problem Identification & Assessment
2. Containment and Interim Action
3. Root Cause Analysis
4. Permanent Corrective Action Plan
5. Verification of Corrective Action Plan
6. Controls & Prevention
7. Verify Corrective Action Plan Resolve Issue
8. Lessons Learned

Fig. 2

TOPS and 8D methodologies prevent recurring problems by three means: First, the identification of true root causes of problems followed by application of solutions that permanently "kill" the root causes. Thus the opportunity for reoccurrence is greatly reduced. Second, through the application of *lessons learned* or as Japanese OEM's call it - *yoko-ten*⁴. *Lessons learned* means that similar problems with the same root causes are prevented at other manufacturing sites or other product lines or processes. Finally, the best solution is one that *mistake proofs* a process. This can be called a *fail safe* solution, or *poka-yoke*⁵.

Although other newer problem solving techniques have been introduced such as the Shainin⁶, TOPS and 8D remain the most common problem solving methodologies used by many automotive suppliers.

In the meantime, Japanese OEM's were using somewhat similar cause and effect techniques and were encouraging use of these techniques by their suppliers. The Ishikawa⁷ or Fishbone Chart forced problem solving teams to visually display cause and effect relationships.

The four possible categories of root causes were displayed on the Ishikawa Chart. These 4M's – Man, Method, Machine, and Material – were systematically checked for root causes.⁸ To drill down to the fundamental causes, teams were told to ask “why” at least five times (called 5Y's). As well the Japanese recognized early that the *root cause* of a problem is not found in the *effect* of the problem, but rather the cause is found in the *process* that led to the problem.

The key to using these cause and effect problem solving techniques is “going to gemba”. The cross-functional 8D team goes to the process itself to see for themselves what is happening in the process. At the process, the cross-functional problem solving team carefully observes *the man, the method, the machine and the material* for clues for causes. Data is gathered and examined for further clues: machine and tool maintenance histories, employee training records, samples of defective parts, material analyses, supplier quality records, internal quality records and the like.

Cause and effect problem solving techniques are not unique to the quality function or to the automotive industry. They are used in aerospace, healthcare and other industries. They are used by teams that investigate on the job accidents and transportation disasters such as plane crashes and the like⁹. Anytime problem recurrence can cause loss of life or other disaster, cause and effect techniques are employed.

How 3B Analysis Is Used to Enhance TOPS/8D/Fishbone/4M Analyses

When the investigation by a cross functional, problem-solving team leads toward a “man” category of root cause, 3B Analysis provides a better way to identify and quantify possible “man” root causes. Before explaining how, let's look at some of the difficulties teams have when investigating the “man” category of root causes.

Four types of difficulties are often encountered when investigating “man” category of root causes.

1. Rushing to solution
2. Treating “low employee motivation” and other similar summary statements as root causes
3. Not pursuing the 3B's – the three categories of causes for low employee performance.
4. The reluctance to go to the source of the problem for the “man” category of causes.

Rushing to Solution

TOPS and 8D are designed to avoid the *rush to solution* and most often succeed, except when it comes to the pursuit of “man” category causes. Team members are tempted to directly apply “man” solutions that they are familiar with for solving “man” problems, especially when low employee performance is suspected. These familiar solutions include retraining, replacement, reprimand, or changes in policy, procedure and changing pay or other incentives.

Treating “Low Employee Motivation” and other Summary Statements as Root Causes

This leads to the second difficulty— treating “low employee motivation”, “poor training”¹⁰, “intentional errors”, and other summary statements about low employee performance as a root cause. “Low employee motivation”, “poor training” and “intentional errors” are broad and general statements of cause that invite similarly broad, general and ineffective solutions such as “remind all employees about the importance of doing quality work”, “retrain all employees”, and “enforce discipline”. Only by understanding the process of how groups of employees and individual employees arrive at their level of motivation and performance in a given situation can teams find real root causes for low employee performance.

“Intentional errors” are particularly difficult to deal with when investigating “man” causes. How does one determine the root cause of this behavior? How does one fail safe or poka yoke intentional errors? Employees for various reasons may want to remove fail safe devices or will fail to use them. Employees also may not fully buy in to management systems and procedures. Sometime this can become a common cause variation¹¹ if groups of employees believe that rewards are greater for not using fail safe devices than using them, or if they believe that rewards that they want cannot be achieved unless they do not use or they defeat these fail safe devices. In some cases, fail safe devices can make processes undoable for employees. However, employees may be reluctant to tell the managers that put the fail safe solution in place that the solution doesn’t work. The creativity of employees can be misdirected toward finding a way to beat a fail safe device or method, rather than being directed to help solve the problem. 3B Analysis can help teams drill down to the root causes of intentional errors and help you protect the integrity and effectiveness of your fail safe devices and methods.

Not pursuing the 3B's – the three categories of causes for low employee performance.

The third difficulty encountered is not pursuing the three categories of root causes for low employee performance. Just as 4M analysis forces problem solving teams to systematically examine all four categories of possible root causes – man, method, machine, and material – 3B Analysis forces problem solving teams to look at all three categories of root causes for low employee performance:

Belief 1 – Confidence

Belief 2 – Trust

Belief 3 - Satisfaction

The reluctance to go to the source of the problem for “man” category of causes.

The fourth difficulty faced by problem solving teams is the reluctance to go to the source of the problem when pursuing “man” category root causes. . Gemba is the location where the problem is occurring. When it comes to employee performance problems, “gemba” is the employee – the point where the actual problem is occurring. Within each employee is the *process* that determines the level of employee performance and effort. To find the cause of the effect (low employee performance) one must know how to analyze the *process* within each employee. For example, an 8D team will go to gemba to pore over a machine to pursue possible “machine” root causes – preventive and predictive maintenance records will be examined, the machine may be disassembled to check for wear or proper operation, alternate machines may be considered. The team may use video or electronic monitoring to check for machine or method problems. This is relatively easy as the team is dealing with an inanimate object. Maintenance and engineering people, skilled at trouble shooting machine problems are typically members of problem solving teams.

Two Process Locations, Two Gembas

*Location of
Manufacturing
Process*

*Man, Method,
Machine,
Material –
the 4M's
interact
here to
determine
the success of
manufacturing
process*



*Location of
3B Process*

*Confidence,
Trust,
Satisfaction -
The 3B's
interact here
to determine
the level of
motivation &
performance*

Fig. 3

However, when teams turn to possible “man” root causes, new obstacles to investigation present themselves. Human emotion and trust come into play. Managers, in particular, don’t want to destabilize manager/employee relationships even if destabilization is the price for improvement of employee performance. Team members are generally not trained on how to trouble shoot for low employee performance problems. Neither do team members have the communication skills needed to gather information from employees that may be having performance problems.

Additional Difficulties Occur When Teams Look for Solutions to “Man” Problems

Teams not only run into problems when investigating “man” problems, but they run into problems when establishing solutions for “man” problems as well. Even if correct root causes are determined, managers in particular are often determined to impose their own solutions for low employee performance. Managers, after all, are talented at developing solutions to problems. Teams must understand that the best solutions are often known by the person most familiar with the situation: the employee with the performance problem. Managers and

teams need to be trained to help employees develop their own solutions for low performance in a participative atmosphere.

Using 3B Analysis Helps Overcome These Difficulties

3B Analysis offers new ways to find root causes and solutions for “man” category causes. Skilled Hayes Group trainers can teach your TOPS-trained employees to see “man” categories in a new light. They will learn the value of “going to gemba” to investigate “man” category causes. They will learn to quantify each of the 3B’s as an aid to root cause determination. They will learn how to develop participative solutions that “kill” root causes of low employee performance. 3B Analysis will help teams avoid overly broad “man” causes such as “low employee motivation” and trite, ineffective solutions such as “retrain all employees”. *Figure 4* below shows how 3B Analysis can be incorporated in a fishbone diagram.

Engineering and operations employees dominate 8D teams. Most TOPS training programs recommend that 8D teams should be led by a design engineer. After all, the team must possess the technical qualifications to solve the problem at hand. 3B Analyses presents an opportunity for human resources professionals and other that are trained in both TOPS and 3B Analysis to participate in 8D teams to insure that the team has sufficient “technical qualifications” to solve “man” problems.

Using 3B Analysis to Determine “Man” Root Causes on a Fishbone Chart

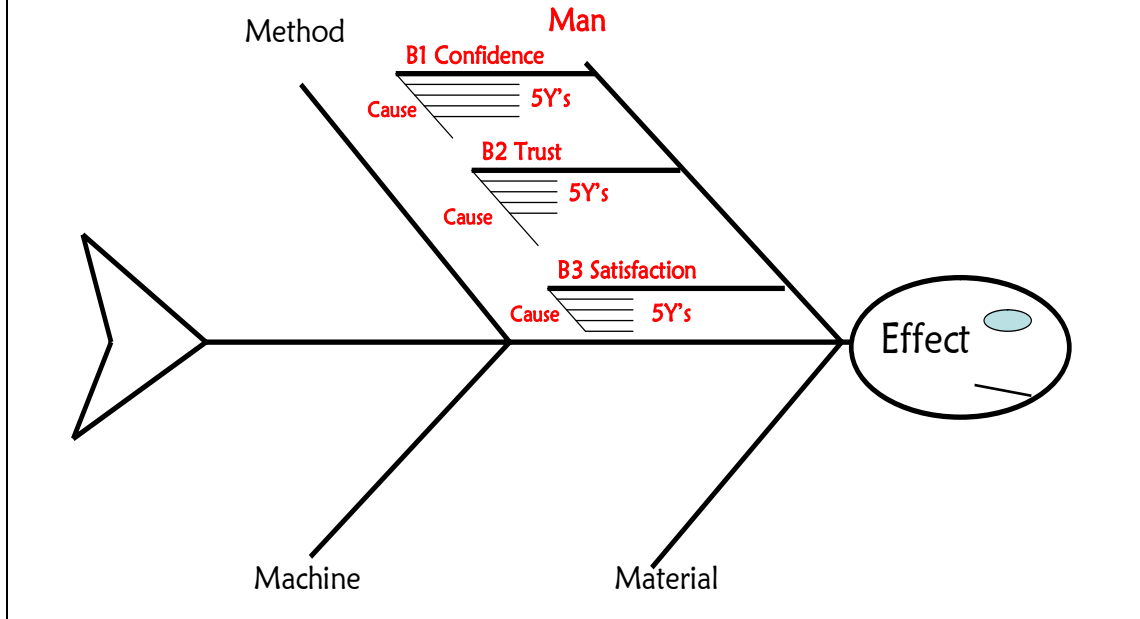


Fig. 4

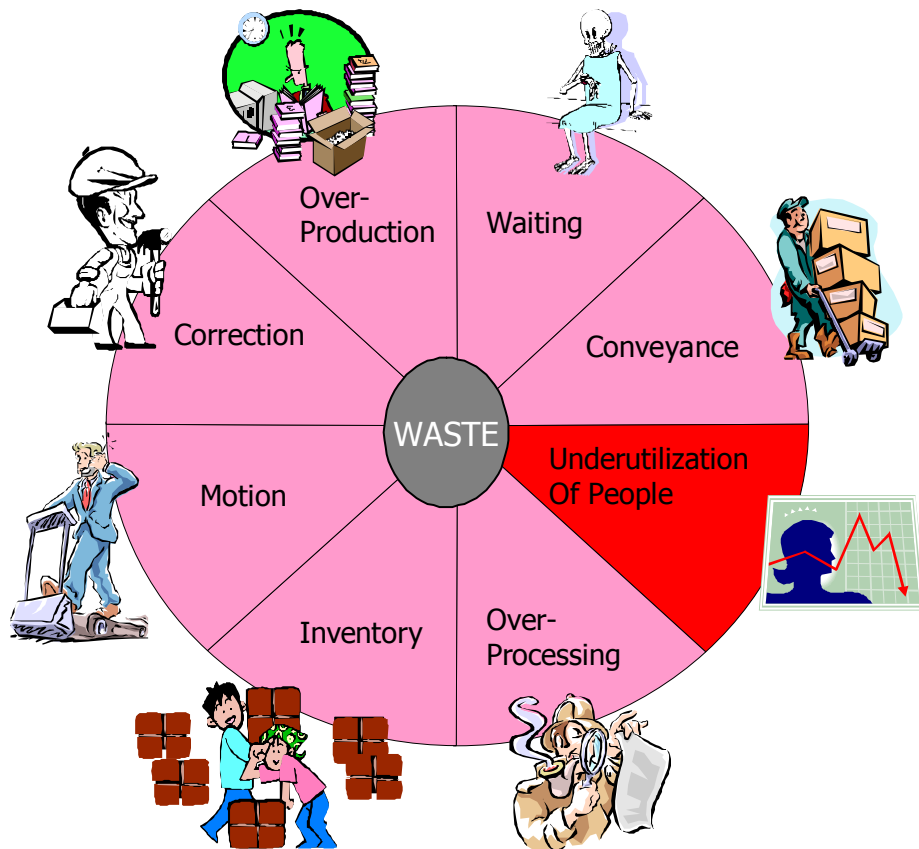
The Elimination of Non-Value Added Activity (Waste)

The second common demand made by OEMs to automotive suppliers is elimination of non-value added activity. This is important for several reasons. Elimination of non-value added activity is at the forefront of lean enterprise management¹². Even those automotive suppliers that haven't progressed to lean enterprise status recognize the importance of eliminating non-value added activity (waste) as a way to reduce cost and increase profits. OEM's are willing to pay for value-added activity and profit, but are unwilling to pay for waste and inefficiency.

Toyota executive, Taiichi Ohno, called it “muda”, the Japanese word for waste. Ohno listed seven forms of waste – conveyance, over-processing, inventory, motion, correction, over-production, and waiting. Rightfully so, some have now added an eighth form of waste called *underutilization of people*. See the “muda wheel” in Fig.5 below.

The Muda Wheel

Fig. 5



Underutilization of people is unique among these eight forms of waste for two reasons. First, underutilization of people is the most difficult of the eight forms of waste to identify, measure and eliminate. Second, full utilization of people is required to successfully attack the other seven types of waste. Womack and Jones point out in their landmark book, Lean Thinking, that transformation to lean enterprise requires people that “throw their hearts and minds” into their work. People that “throw their hearts and minds” into their work do this because they are highly motivated and thus deliver a high level of employee performance.

What is meant by underutilization of people?

To employ people to simply do work, while failing to fully utilize their brains, their creativity, their enthusiasm, and their discretionary effort.

Lean operations require that each employee is *capable* of performing at their maximum depending up customer demand. Without inventories to buffer low employee performance, employees must reliably operate at a high level of performance. For example, Total Productive Maintenance (TPM) insures that *machines* perform at their maximum and are always ready to meet customer demand (pull) at any given time. 3B Analysis insures that *people* perform at their maximum and are always ready to meet customer demand (pull) at any given time. Lean requires flexible, horizontally cross-trained employees that can shift quickly to new tasks, but it also requires employees that consistently perform at a high level of performance to avoid muda due to underutilization of people

An objective of lean manufacturing is to eliminate waste and to achieve a state of *uninterrupted flow* where processes are optimized and waste is eliminated. Employees that are highly motivated in lean operations achieve what Womack and Jones in *Lean Thinking* call “*flow in work, work as flow*”. In the same manner that business and manufacturing processes achieve flow – work proceeds through a series of value-added standardized steps with no waste – people achieve a satisfying state of *psychological flow*¹³. 3B Analysis can help you achieve this state of flow in your employees.

Everyone agrees that underutilization of people is bad, but how can an automotive supplier identify, quantify and improve the level of utilization of people in a given cell, department or work team? How can an automotive supplier determine the root causes and solutions for underutilization of people?

3B Analysis can be used to “map” and quantify utilization of people in a department or cell¹⁴. Here is a typical Hayes Group facilitation:

A plant with several hundred people is in the process of lean transformation and is in search of waste. A manufacturing cell containing twelve people is selected to be a pilot for measuring the utilization of people in the cell.

Step One: Hayes facilitators meet in small groups for two hours with cell members to explain the basics of 3B Analysis. The purpose is to influence cell members to be open and honest when looking at their 3B’s. Each cell member must be willing to put his or her name on the 3B Analysis instrument called the *Motivation Profile*. This instrument consists of a series of especially designed questions that each cell member answers. Skilled interpretation of the answers to these questions allows quantitative scoring of each of the 3B’s for each cell member. High scores on all 3B’s mean high cell member motivation and performance. A low score on one or more of the 3B’s means low motivation and performance.

Step Two: First, B1 Confidence is analyzed and scored by Hayes facilitators to identify specific cell members that are at the low end of scoring for B1 Confidence.

Step Three: B2 Trust is analyzed on the completed Motivation Profiles. Unlike B1 Confidence, B2 Trust is “manager driven”. B2 problems tend to be systematic in cells. Therefore the target is the cell as a whole rather than the individual. An average B2 score for all members of the cell is helpful here to quantify the current state trust. B2 problems can be a source of common cause variation¹⁵ in processes.

Step Four: B3 Satisfaction (Dissatisfaction) is analyzed and scored. B3 Satisfaction is charted both for the cell as a whole and by individual cell member as B3 problems can be systematic and/or individual.

To complete this systematic analysis of this pilot cell, we must overcome scoring problems. Although precise scoring of each of the 3B’s is not required, various scoring problems may occur. Some examples follow.

In general, B1 Confidence Causes are difficult to admit (Can I do it?). Cell members will be reluctant to discuss their shortcomings and may not tell the complete truth about this belief. B1 causes, however, have easier solutions – improved training, different training, more realistic expectations, or reassignment.

B2 Trust Causes are openly discussed among cell members, but may be difficult for the cell member to admit to the manager because they sound like complaining (the system of rewards around here stinks!). B2 problems are serious business and take a long time to correct as they are systematic and require significant organizational change.

B3 Satisfaction Causes are difficult to score in that cell members are often vague about them. A cell member will readily admit that she is dissatisfied, but will be reluctant to discuss the specifics needed to score this type of cause. A cell member will be reluctant to reject the reward that the manager may have personally put in place for the cell member.

The 3B scores for the pilot cell are in. Management has “mapped” the current level of utilization of people in the cell. The “current state” is known. .

Scoring the 3B’s and uncovering causes of low performance and underutilization “de-mystifies” the solutions needed to eliminate the root cause. Most often the best solutions come from the cell members with the problem. Although the solution suggested by the cell member may not

always be acceptable to management, the solution suggested is often more simple, less costly and more effective than those suggested by managers. Asking the person with the problem to suggest a solution also develops shared responsibility for making the solution work.

A Third Use for 3B Analysis

We have seen how 3B Analysis can improve TOPS/8D problem solving, and we have seen how it can identify, measure and eliminate waste due to underutilization of people. 3B analysis has a third use – solving individual employee performance problems.

Skilled Hayes Group trainers work with individual managers to teach them the techniques of 3B Analysis. This can usually be accomplished over a period of one to two days. This tool is also valuable to train human resources professionals so that they can better assist in the investigation of employee performance problems.

Summary

We have seen how 3B Analysis can help you solve three types of problems in your organization and help you to reduce costs: Improving the performance of TOPS/8D teams, reducing waste and cost due to underutilization of people, and a general employee performance diagnostics tool for managers.

You check your machines, raw materials, products and processes one by one to insure maximum performance. Why shouldn't the same organized one by one effort be expended insure that your people are performing at their optimum level?

¹ Kaizen is the Japanese word for continuous, incremental improvement.

² Gemba is the Japanese word for "scene of the crime", the place where value is added. Japanese society is highly structured and places great value on consensus and harmony. How can one then solve problems in such a society? One creates a deliberate destabilization at gemba – issues are looked at directly, root causes are determined, and countermeasures are implemented quickly to allow a return to harmony and consensus.

³ The 8D technique was invented at Ford in 1987

⁴ In Japanese, Yoko-ten means "lateral explosion". It is used by Toyota and others to describe the necessity of lessons learned - what is learned in one problem solving session should not have to be learned all over again, after a mistake is made, in another problem solving session. Likewise, what one factory has learned should not have to be learned from scratch at another factory.

⁵ The Japanese term for a mistake-proofing device.

⁶ See www.shainin.com for more information about Shainin problem solving techniques such as "Rolling 5", "Green Y and Red X".

⁷ Ishikawa was a Toyota engineer and a contemporary of Deming.

⁸ Rather than the 4M's, some use PEMPEM – Plant, Equipment, Materials, People, Environment, Methods. In each case, human beings (man or people) have to be considered as category of possible causes.

⁹ Tenneco Automotive uses formalized 8D Techniques to investigate health, safety, and environmental incidents in their operations. See www.tenneco-automotive.com.

¹⁰ Elsmar, Inc. at www.elsmar.com.

¹¹ Common causes of variation are due to sources of variation built into a system. Such causes are always present when a system is operating. Special causes of variation on the other hand are causes attributed to a single event or related set of events often due to human error.

¹² Lean Enterprise is achieved when all non-value added waste is eliminated from product design to product delivery. Products are produced based upon the “pull” of customer orders rather than simply mass produced at the lowest possible unit cost and stored in warehouses waiting to be sold.

¹³ Mihaly Csikszentmihalyi (CHICK-sent-me-high-ee), a professor and former chairman of the Department of Psychology at the University of Chicago, is credited with using the term “psychological flow” to describe, “being completely involved in an activity for its own sake. The ego falls away. Time flies. Every action, movement, and thought follows inevitably from the previous one, like playing jazz. Your whole being is involved, and you’re using your skills to the utmost.”

¹⁴ A key tool for identifying the seven forms of waste is the process flow chart which identifies value-added and non-value added activity. Just as the process chart maps the process and identifies opportunity to identify and eliminate the seven forms of waste, 3B Analysis maps the process that individual cell members use to determine their level of motivation and effort. This latter process occurs *within* each person and can only be mapped through 3B Analysis.

¹⁵ Common Cause Variations are variations in the system itself. Unless problems solving teams find true root causes and solutions for common cause variations, they will continue to be present and will affect output. Root causes of common cause variation can be found in all of the 3B’s, but are most commonly found in B2 Trust. B2 Analysis can uncover systematic behavioral problems in a cell or department that can be a continuing source of common cause variations. For example if a team leader lets it be known to employees that they will be rewarded for saving time more than they will be rewarded for strict adherence to a permanent corrective action that has been put in place by an 8D team.