THE LIMITING FACTORS OF SAFETY MANAGEMENT AND HOW THEY CAN BE OVERCOME

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"The usual reaction of almost everyone, when an accident occurs, is to attribute it to somebody's carelessness or to something unusual about the equipment used. It is wise not to jump to this conclusion: it may lead to the wrong answer, wrong solution, continued trouble, more accidents."

W. Edwards Deming

Abstract

Traditional safety management based on the methods of command and control are no longer relevant in the new economy. The aim of this article is to explain why safety management should be transformed to the management theory and methods for continual improvement prescribed by Dr. W. Edwards Deming.

Introduction

When it comes to the workplace American culture, with its emphasis on rugged individualism, re-enforces the belief managers have that people are in complete control of their actions at all times. Combining this conviction with common sense they find it reasonable to hold people accountable for almost everything that goes wrong on the job; especially employee accidents. Deep down inside American managers believe if workers would only give that extra effort to follow the safety rules, regulations and job instructions on-the-job accidents would be a non-issue. This thinking has established a fatal flaw in the logic of safety management since the days of Heinrich, considered the father of industrial safety in the U.S.[1], to the current uncritical application of the pop psychology of behaviorism to safety. That is improving safety is mostly a matter of fixing the behaviors of workers. This theory actually prevents continual improvement of safety performance. There is a better way.

Over 30 years ago the social scientist Gerald Salancik conducted a simple experiment. An individual was instructed to operate the controls of a model train as it ran around a track. Another person was asked to observe the individual operating the controls. Neither one knew the experimenter actually had control of the train and he could make it go slower or faster and even cause it to derail. The person operating the train quickly realized he had limited control over it. In spite of his best effort he could not make it run smoothly. While this was happening the observer could not *see* someone else was actually controlling the train. He assumed the derailments were the fault of the operator of the controls not to the unexplained and unseen factors. He was committing what is known as a *fundamental attribution error*. [2] This assignment of blame due to the inability to understand and see what is going on in the system takes place daily in most companies. It is particularly rampant in traditional safety programs.

Should a supervisor tell a worker when they have made a mistake? Of course, Why not? Today most safety managers believe it is good safety management to point out when employees have committed an unsafe act. How else could they know they did something wrong? They also believe some simple feedback will motivate employees to behave safely in the future. Common sense tells us employees should be held accountable for their actions and accept responsibility since they cause accidents. This is a typical conclusion of accident investigations. (The initial formal accident investigations of Three Mile Island all blamed the operators for the accident.) [3]

When using this theory solving safety problems is a straightforward and simple proposition; hold people accountable (Seems reasonable) then apply positive re-enforcement to change their behavior (Be nice about it). The method is neat; clean, quick and easy. It is also wrong.

When managers observe people on-the-job and assume their unsafe behaviors are uniquely of their own free will they are committing a fundamental attribution error. They ignore or don't seek to learn about all of the influences, constraints and processes in the system that affect what a person thinks and does now and in the future. They make snap judgments about a situation and focus on the individual because they can *see* and judge the worker has done something wrong. This is single event thinking. It's the same as believing you can know everything about a movie after viewing just one frame of the film. But work is much like Salancik's train experiment. There are hidden forces that influence people's thinking, attitude and behavior on-the-job.

Basically people do not come to work to injure themselves. Managers know this. Which begs the question, with all the safety programs and the built in self-preservation factor of workers why do we still have over 4 million employee injuries and between 4-5,000 fatalities at work every year in the U.S?

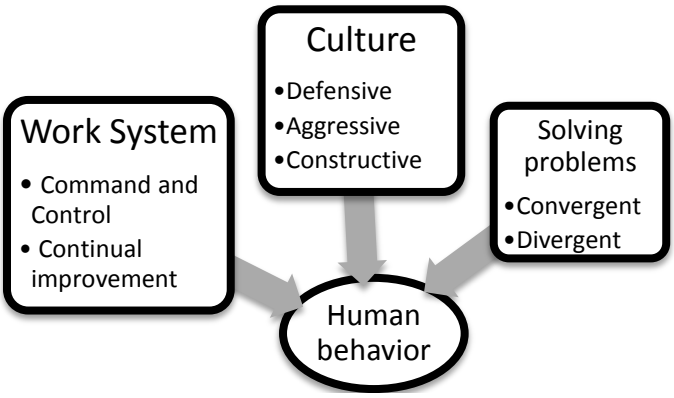

Figure 1 Limiting factors that influence behaviors on the job

All theories are correct - in some world. With all due respect to Heinrich he got it almost exactly wrong when he theorized *unsafe acts* of workers cause 88% of all industrial accidents. But how could he know? In his time and circumstances command and control management was at its peak. His work certainly people to at least think about safety. But today his theory is inadequate. We now know work systems have limiting factors that determine their outcomes such as waste, scrap and defects. It should be noted that all the management books explaining continual improvement conveniently exclude employee injuries in these outcomes. Three major limiting factors of work outcomes are the culture, the actual work system and the methods management uses to solve problems.

It's time we realize preventing injuries by observing and analyzing what a person does for a split second just before an accident happens is not "good enough." We need to correct the common attribution error management makes about what causes employee injuries and offer a more constructive solution to the problem.

The Work System: Command and Control vs. Continual Improvement

"*It is not sufficient to improve processes. There must also be constant improvement of design of product and service and new technology. All this is management's responsibility."* Deming

The work system is an obvious driver of people's behavior. It provides the instructions to tell who, what, where, when and how jobs are to be performed. These instructions are its infrastructure. American managers are most familiar and comfortable with the command and control or the *Thou Shalt* infrastructure. It's simple, the boss tells a *subordinate* what to do and they do it. It was adopted for mass production in the early 1900's and dominates American companies to this day. [4] It is often described as the "park your brains at the door" management method and has been depicted in the organizational chart with workers having no heads shown below.

In this system thinking is not an option for workers. Nonetheless managers often chastise them for "not thinking" when things go wrong. Supervisors spend most of their time putting out fires with little or no concern about why they happened. Command and control management works just fine for quantity or mass production and American companies dominated the world by using it after WW II. But nothing lasts forever.

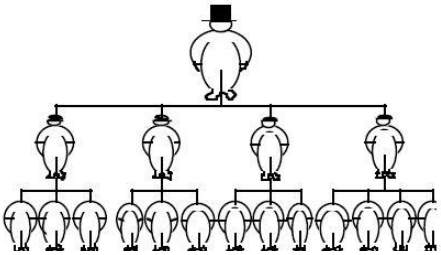
Figure 2 Thou Shalt Management Structure

By the 1970's work systems around the world led by the Japanese began to change and in1980 Dr. W. Edwards Deming was re-introduced to American business. He called for a transformation not just a reformation of American business. When you reform a system you leave it alone but try to change its behavior. When you transform a system you change its goals or objectives.

In mass production the primary quality objective is to "meet specifications." When you manage for continual improvement the quality objective is consistency. Deming's basic message to managers was you don't get ahead by building products, separating the good from the bad through final inspections and deliver only the good ones to your customers.[5] To get ahead you manage operations so defects aren't built in the first place. This is a different objective than mass production. It requires a different way of thinking about management which Dr. Deming developed and expressed in his 14 Points.[6] Instead of focusing on maintaining the status quo you focus for continual improvement by removing faults in the system that cause unwanted outcomes. Managing for continual improvement applies to safety as well as quality. Sadly traditional safety management has

misinterpreted Deming's call for improving people. They take it to mean fixing the worker's behavior not increasing their knowledge.

Deming's simple but profound message launched a paradigm shift in management. Quality was no longer just a matter of meeting specifications for which command and control was adequate. To make products as consistent as possible requires managing for continual improvement of everything involved in the work system. Dr. Deming told the Japanese focusing on quality and managing for continual improvement would give them a competitive advantage and it did.[7] The new management model made it clear to achieve high quality you must learn how to continually improve processes and reduce variation for the benefit of the customer. Ultimately everyone in an organization needs to working on this objective. This is especially true for safety.

Contradicting all traditional management teachings, Dr. Deming said to optimize the system and benefit customers all components must cooperate not maximize themselves and compete with each other. To that end managers must become leaders and system thinkers; i.e. learn what is a system and how does it function. They must understand there are times when one part of a system may take a loss so the system as a whole will gain. Managers must learn how to study the whole and why most outcomes of a system result from the products of the interactions of its parts not the actions of an individual worker. When people participate in any work process they are exposed to the variation of these interactions and management must learn how to deal with this. Managers must come to grip with the fact you can be influenced by things not always closely connected in time and space or under your control or both. Managers cannot *see* any of this unless they abandon the paradigm of command and control which denies or ignores variation.

Work is not a static system. Work processes are interdependent; filled with variation and create undesirable outcomes such as scrap, waste, rework and employee injuries. Command and control theory assumes cause and effect are closely connected in time and space. When something goes wrong the supervisor is required to find out who did what, and straighten them out.

Continual improvement management requires supervisors to react differently. They are trained to step back and determine if a problem is the result of faults in the system or something unusual that may never happen again. It's not enough to know what went wrong and all the details about a problem but *why* it happened. Managers know their job is to make reliable predictions about outcomes of the work systems. The majority of their effort is spent finding and removing barriers and constraints in the system that prevent it from making products or service as consistent as possible in a safe working environment. Because their objectives are different, fix the system vs. fix the people, command and control and continual improvement methods cannot be reconciled. They don't work when used concurrently because their objectives contradict each other. You are free to practice one or the other but you can't use both at the same time. Command and control management works fine for mass production and low quality but it will cause chaos when your objective is continual improvement of your system no matter what outcome you are working on.

Culture

> *"Organizational cultures are major sources of the constraints that influence our behavior."*
> Russell Ackoff

Culture is another force that shapes individual thinking and actions in any organization. It is more subtle but equally and often more influential than the work system and problem solving. Like quality, culture is difficult to define. For our purposes we will define it as the shared values, beliefs and thinking that influence the attitudes and behaviors of people in an organization. Basically it's how things get done in a company. It's been said that culture is so powerful it trumps strategy every time and there is plenty of evidence to support that statement.[8]

Popular opinion has it that changing the way people think and the culture of an organization is next to impossible. Management in a lot of companies is content to accept this premise. They use it as an excuse to ignore or deny the problems culture can cause. But research in the field of psychology on people's thinking and corporate culture suggests both can be changed in a fairly short time frame.[9] A quick review of business publications reveals it happens all the time.

The late Dr. Clay Lafferty believed if given the right set of tools people could do a pretty good job of improving how they relate with each other and the culture they work in. To do this he developed statistically valid diagnostic

instruments organizations can use to define its current culture; compare it to what people believe is an ideal culture and plan how to reduce any gaps between the two. This often requires people to change their thinking which, contrary to popular belief, can happen quickly if it is self-induced. The point is when it comes to culture we can now measure it and obtain valid data previously unknown and unknowable.

Operational definition for culture

Many managers avoid working on culture because it is so difficult to define. Fortunately we can take the mystery out of the *meaning* of culture by borrowing a tool used in quality management called an *operational definition*. An operational definition is a procedure people agree on to translate a concept into a meaningful measurement. The term was first coined by the physicist P.W. Bridgeman to help scientist agree on abstract ideas.[10] To create an operational definition two or more people agree on the test to be performed and criteria to be measured. Once you have done this you can make a *yes* or *no* decision whether the concept being measured met the criteria. Operational definitions give us the ability to communicate with each other so we can agree on ideas such as, what is: round, reliable, safe or an ideal culture?

An organization can create an operational definition of culture and learn what employees believe is an *ideal* culture. This will give people a system to measure and improve culture. The following is an example of how it could be done :

1. The members of the organization will complete a statistically valid culture survey to describe its current culture.
2. The same members will then complete another survey and describe an *ideal* culture.
3. The results of the *current* culture will be compared to the *ideal* culture to determine if any gaps exist between them.
4. If no gaps exist between the current and the ideal the organization has an ideal culture.
5. If any gaps exist between the two the organization does not have an ideal culture.

Having an operational definition for culture will take the ambiguity out of dealing with it. An organization can work on closing any gaps identified between the current and the ideal. Like a statistical process control chart the operational definition is not a solution to the problem. But from the standpoint of culture it will help people agree on what kind of problems they have. From there they can get to work on solving it.

Problem solving

The most obvious difference between continual improvement and command and control is how managers handle problems. The former works with the premise the majority of the outcomes stem from common causes built into the system or special causes which are not part of the system. The latter assumes most problems can be traced to specific misbehaviors of people. Hence all the time, effort and action by management directed at motivating and controlling people such as annual performance reviews or in the case of safety observation and behavioral feedback. These techniques will not work for common causes which are best addressed by teams of people applying the Plan, Do, Study and Act cycle.

Once you have identified a common or special cause further refinement of the problem is necessary. Essentially managers face two types of problems; convergent or divergent.

Convergent problems have *a* solution. The more you study them the more the answers converge. If you are building a safety guardrail and want to know the nominal height required to meet OSHA regulations there is *an* answer. (42")

Divergent problems are different. As people with expertise about a divergent problem study it, they develop what appear to be equally valid yet contradictory solutions. If you ask the question, "What is the most effective way to manage a safety program?" Intelligent people will offer many different valid, useful yet contradictory answers.

Managers working in a command and control mass production environment have little choice but to treat every problem as a special cause with a convergent solution. The local supervisor has to develop quick solutions to problems so he can keep production going. He does the best he can as quick as he can to take care of what's wrong. That's what he's paid for. Of course this precludes him from spending any time to determine *why* things happen so they can be prevented in the future. He is always too busy fighting fires.

The problem solving challenge for safety management

The ultimate objective of all safety programs is to prevent people from getting injured. So the important thing to ask is: What causes employee injuries? It is a simple yet profound question. Deep down inside most managers believe employee injuries are caused by the unsafe acts, carelessness or the behavior of workers. For them solving most safety problems is a simple matter of fixing the person. Applying this line of reasoning they will be too busy focusing on people's behavior to ever consider if they are doing the right thing.

It is the lack of management's serious examination of this basic question that prevents continual improvement of safety performance. It should remind us that behind every complex problem there is a simple, easy solution – that is wrong! In this case it is wrong because we are committing a very common mistake in problem solving; classifying producers and symptoms as causes. Attacking unsafe acts as the method to prevent employee injuries is the same as a doctor prescribing aspirin for a patient with appendicitis. It gives management and easy out or an *instant pudding* solution to the problem. It does little or nothing to prevent employees from being injured. That requires working on the system, which is the biggest challenge for safety management.

We manage safety by focusing intensely on the local outcome of the system. With our propensity for analysis when an accident happens we break it down into its parts to see what has gone wrong. We even go so far as to look for a *root cause*, the one thing that if corrected would prevent the accident from happening again. When we find it we fix it and put things as they were before the accident happened. (Note: this is not continual improvement only putting things back the way they were.) Since people are always involved it is easy to conclude an employee's behavior caused the accident. By focusing exclusively on the event (the accident) it is easy to conclude the person could have easily prevented the accident if only they chose to be more careful. In the eyes of a non-systems thinker this establishes a strong cause and effect relationship hence unsafe actions are often interpreted as the primary cause of accidents. This line of thinking originated with Heinrich and lives on to this day. From this perspective accidents are a convergent problem with an obvious solution.

Using this line of thinking management treats safety as a requirement not an objective. At that point when it comes to preventing accidents fixing employees behaviors is "good enough." This is called satisficing and it neglects the fact the same approach was tried to improve quality and it didn't work. It prevents management from pursuing the best most efficient course of action to give optimal results. American companies learned the hard way (Many went out of business.) that to improve quality they had to improve their systems not the behaviors of the hourly people. Until this happens management sees little value in learning how faults in the system or common causes are responsible for most accidents.

Management must come to understand why investigating every single defect or accident in a stable system will be ineffective and cause more trouble. You are treating every accident as a special cause when in fact in a stable system the causes that produce employee injuries are upstream built into the system.

Mistaken identity – Causes, Producers and Symptoms

It is true almost every employee injury includes an unsafe act but unsafe acts are a variable of the problem not a cause. When it comes to problem solving it is important to classify variables correctly and then determine how if at all they are related. We assume unsafe acts are directly associated with accidents. When there is an association between two variables either can be used to predict the value of the other. But non-systems thinkers make an error in the casual inference between them. We have not given enough critical thought about the classification of unsafe acts relative to an accident.

Accidents are like bacteria. They are all around us. Most accidents are harmless but some have serious consequences. The same can be said about unsafe acts. From a systems viewpoint unsafe acts are more accurately classified as either a producer in the accident chain or a symptom of something inadequate in other components of the system; not the least of which are its culture and work systems.

We know an unsafe act on its own does not always bring about or cause an accident. It is more accurate to classify them as producers. Producers have only a weak relation between things and may have some probability of producing an effect, but it is not certain they will always do so. This is very much the case of unsafe acts. Most of them are harmless. The key is to think about what happens to change an unsafe act from being totally harmless to a producer

related to an accident. When is it probable an unsafe act would result in an accident in your processes? This is something management must develop knowledge about.

It's been known for years how people behave on the job depends on how they are treated by management from day one. In other words the system creates employee behaviors. If it is important workers do not commit an unsafe act because of the hazards in a job that is a system problem. Management should be aware of it and it is their responsibility to know what to do about it. Appropriate and adequate measures should be taken in the form of safety design and training and then continual improvement of safety in the work processes. A system filled with hazards must be designed so unsafe acts are an exception not the norm and if they do happen the system should be designed with redundancies that will mitigate them. This action can only be taken by management not the individual.

A symptom is an indicator caused directly by something else. An increase in your body temperature is a symptom that could be caused by many different things. In most cases unsafe acts are caused by something amiss in the system therefore they are symptoms. People do not intentionally perform unsafe acts. They start out ready, willing and able to learn their jobs and do them safely. Everyone has the potential of becoming a highly productive employee if all things required to make this happen are available and take place. This involves optimization of the system. Optimization requires all parts of the system cooperate not compete with each other to achieve desirable outcomes. i.e. employees properly trained so they understand what are the behaviors required to be safe; and supervisors ensure the persecution of production with all of its negative effects on safety does not exist in daily work routines.

When it comes to safety non-system or single event thinking resolves problems by *saticficing* which is accepting solutions that are "good enough." Contrast this with *optimizing* which calls for seeking solutions that are the best and most efficient. A common example can be seen in safety training. For many different reasons people may or may not adhere to what was presented in a safety training program resulting in "unsafe acts." Even though preventing them is a primary objective of safety training. This introduces a lot of variation into the system which is compounded by many variables over time. This is satisficing since management believes just having people attend a safety training class is good enough, even though it does little or nothing to affect the attitude and behavior towards safety on-the-job over time.

Satisficing allows management to ignore this variation and rid itself of accountability since it has meet specifications. With all its faults management accepts the safety training effort as "good enough." When it is completed it then transfers the responsibility for safety to the individual worker thus allowing managers to inaccurately label anything the worker does as a cause. Inadequate safety training becomes a producer of accidents providing a weak link to causing them as a product. Management that designs and administers inadequate safety training; accepts the variation it generates; then shuns its responsibility for the outcome; has a direct causal relationship to accidents. Ignorance of this reality is evident in safety posters reminding workers – "Your safety is up to you! Or "Safety is a personal choice!" This line of reasoning exists in a culture that believes "meeting specifications" and "compliance" with safety rules and regulations is "good enough." In this world when it comes to safety maintaining the status quo is *the* objective not fixing the cause. From management's view satisficing is a totally acceptable resolution of safety problems.

Improper use of analysis

Russell Ackoff said for the last four hundred years Western culture has relied almost exclusively on *analysis* to solve problems. Analysis has you break down a problem into its parts, examine each one separately to find out what is broken, fix it and put things back together. In a command and control/mass production system analysis is enough because management isn't concerned about *why* things go wrong. Their primary job is to put out fires and keep production going. Done properly all analysis can do is put you back to your original state, not improve it. Analysis can tell you how things work.

Safety management uses analysis to conduct accident investigations which start with the investigator breaking the accident into each part. Then he tries to understand the behavior of each part separately. Then he aggregates the understanding of the parts into the understanding of the whole. At that point he can tell you how the accident happened.

But analysis is severely limited when it comes to solving systemic problems. The reason is when separated from the system individual components lose their essential properties.[11] When the parts of a system are disconnected you

can't understand how they work with the whole. Which means using analysis won't help you learn *why* something happened.

For example *you* are a system. Your legs don't walk. *You* walk. Suppose you were experiencing a serious pain in your leg. Cutting off your leg and examining it intensely as possible will not help you understand why the pain exists. (Do not try this. The results should be obvious without an explanation.) Your leg has to be connected to you and all the components of the system that go into making it work; the spine, your brain, nerves, muscles, bones, blood vessels, skin, etc. The pain in your leg may be caused by a pinched nerve in your spine. The system must be studied intact to determine which connections are not working properly to cause the pain in your leg. You don't perform brain surgery every time you have a headache. We have learned by studying the human biological system a simple aspirin ingested in your stomach will eliminate the pain in your head

So if you want to fix something that is broken and put it back into the condition it was, analysis works. But if you want to make things better analysis won't help you. You can't explain the behavior of a system using analysis.

Synthesis

In a continual improvement management system managers understand they are like the observer described in the train experiment but with one very important difference. They understand the limitations of analysis for determining *why* something has gone wrong in any work system. To improve a system they seek to learn *why* things happen in it from a design and function viewpoint. They know they must look beyond what is immediately observable. To explain a system you must observe and study it as a whole under working conditions. This is *synthesis* and the opposite of *analysis*. Instead of taking things apart to determine what part is broken you keep everything together to see how the interactions of the parts affect the whole to learn *why* something has gone wrong. Contrast this with analysis where you start by taking something apart and extract the properties of the whole from the characteristics of the parts. In other words, in this world the system creates the behavior of the parts not the other way around. It is a different way of thinking about problems and gives you the ability to dissolve them so they won't return.[12] This includes the behaviors of people working in the system. This reality is incomprehensible to non-system thinkers.

Of course even when you manage for continual improvement you must still put out the fires. But you will learn to take time to manage for the long term and prevent things from happening in the first place. So managers must identify what kind of problem they are dealing with and react appropriately. Does the problem come from faults in the system or something outside the system? This requires the thinking and tools of statistical process control or SPC. SPC charts are the best known method for interpreting variation to determine if it stems from common or special causes. [13]

Contrary to popular belief most problems of production, including routine "safety problems" are divergent with their causes and solutions usually lying elsewhere in the organization intertwined with other organizational functions. To address systemic/divergent problems and discover the hidden connections of the infrastructure that are misfiring and causing employee to be injured safety managers must learn how to simplify the complexity of work processes. This kind of problem solving requires synthesis which requires three key things.

> First: You must learn how to obtain statistical data from the system to help you determine what type of problem you are dealing with; a common cause (system) or special cause (local). The former will require divergent/synthesis team problem solving and later can be handled using convergent/analysis and a singular solution. In most systems faults of common causes account for 85-99% of the defects, scrap and employee injuries.
>
> Second: You must develop people with team with problem-solving skills so they will be able to study divergent systemic problems and develop creative *synergistic* solutions. In other words the team's solution reached through consensus will exceed the knowledge of any individual on the team and dissolve the problem. This is true synthesis. This kind of problem solving is achieved by applying the Plan, Do, Study and Act cycle described below.
>
> Third: People must learn about and apply creative solutions using the system of profound knowledge (SoPK). This is a system to transform organizations from traditional Western style command and control management where the primary objective is to control behavior of people; to optimization where the objective is to continually learn about and improve all things in your system to benefit your customers.[14]

Plan, Do, Study and Act Cycle

There are many different methods for problem solving. They range from just plain common sense to specialized techniques ranging from training on how to be a Green or Black Belt or how to conduct Design of Experiments or Root Cause Analysis. All of them have strengths and weakness but their biggest shortcoming is they all must have a problem to solve. But just fixing problems, reducing waste and defects isn't enough in today's economy. We have to go beyond that and find ways to continually improve everything we do. Detecting and preventing problems will only get you back to where you started.

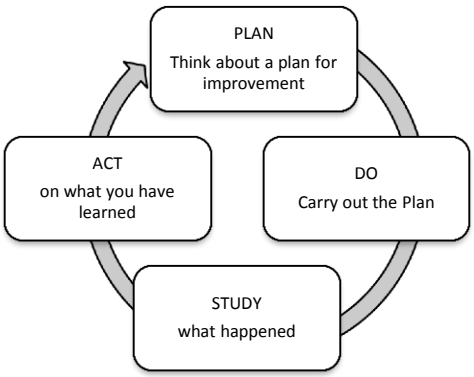

Figure 3: The PDSA Cycle

Continual improvement relies on people being able to learn so they can develop knowledge about the system. The objective is to make things better than they were before, even if you don't have problems now. This requires continual application of the Plan, Do, Study and Act cycle, which is basically the scientific method in a format anyone can use. It is a structured, disciplined, graphical system designed to encourage ingenuity and creativity to improve your present situation. It provides a method to test your theory for improving the system. PDSA also provides forgiveness in learning which is necessary because the only way you learn is to make mistakes and learn from them. With PDSA you do not have to wait until something goes wrong. It relies on the intrinsic motivation all of us have to obtain knowledge to improve the world around us.

Command and control management's theory about people is they can't be trusted. Therefore management efforts focus on controlling employee's behavior. For safety this means most management activities are not problem solving but are concerned with obtaining compliance. Contrast this with continual improvement management theory which starts from the premise that everyone, including hourly workers, is doing their best. People do not hire into a company and come to work with the intention of making scrap or getting injured. The system is responsible for as much as 85% to 99% of the outcomes including employee accidents.[15] This means most problems and inefficiencies are in the system and the system is filled with variation. Therefore control is about restructuring change and directed at making the system, not the people, do what you want it to. When the PDSA cycle is coupled with this philosophy improvement of the system is unlimited.

When a manager knows this his initial reaction to a problem will not be yelling and micro-managing which is often the tact command and control managers take to put out fires. To be effective you must first determine if a problem stems from common causes in the system as opposed to something unusual going on. If it does come from the system you work to find out *why* it happened so you can fix the system. You won't waste time or lose the respect of people by trying to fix the blame.

Continual improvement requires all employees to be thinking all the time and a work system/culture that encourages people to test their ideas effectively. Command and control vs. continual improvement produce entirely different thinking and behaviors on the part of management and workers. The former is what is depicted in a Dilbert cartoon and the later is what you find in companies consistently listed in the "best places to work."

Safety Management – Where are we now?

The transformation will release the power of human resource contained in intrinsic motivation. Deming

The role and relationship between managers and workers in the last fifty years has changed dramatically. In fact it has been transformed. In Heinrich's day the ultimate objective of management for mass production was to control workers. The objective of management now is based on Deming's philosophy that companies must continually improve to please the customer with today's products and services and innovate for their needs in the future. Dr. Deming's 14 Points are a new management theory on how to improve quality and reduce waste, scrap and rework. His theory and methods have turned traditional command and control management upside down and inside out.

Over the years many well-intentioned safety professionals have advocated the use of Dr. Deming's theory. They recognize, as did Heinrich, safety and quality are two sides of the same coin and should be managed the same way. Unfortunately the safety profession's adoption of Deming's principles has been superficial at best. What they say and what is practiced are two different things.

For instance safety managers will say to implement Deming all you have to do is substitute the word "safety" for "quality" in his writings and you have it. Their actions will then contradict just about every principle he advocates in his 14 Points. Some of the most noticeable are:

- Point #1- Constancy of purpose: Management contradicts this principle when it emphasizes enforcement of safety rules and regulations after a severe injury or when accidents increase and pays less attention to safety when they subside.
- Point #2 - Adopt a new philosophy: Heinrich focused management's attention to employee behaviors in the 1930's and it remains focused on it to this day. We now understand behaviors are symptoms not causes. Dr. Deming is adamant that quality was made at the top in the board room and the majority of defects are not the result of miscues by workers. So it is with safety. The system/culture causes behaviors not the other way around. Safety needs a new theory.
- Point # 3 - Cease dependence on mass inspections to ensure ~~quality~~ safety. Build ~~quality~~ safety into production in the first place. Management still believes conducting frequent safety inspections and audits is the most effective way to manage safety.
- Point # No. 5- Improve constantly and forever the system of production, service, planning, or any activity. Management violates this principle when it believes a perfect system can be designed up front that will eliminate accidents or there is one best way to do a job. Once that is figured out anything that goes wrong is the result of workers not paying attention. This over confidence that engineering can design an optimal process and eliminate all safety hazards shows the lack of understanding about systems and variation. It is a spreadsheet mentality in planning assuming that fixed or linear relationship exists in all variables. "*No system, whatever be the effort put into it, be it manufacturing, maintenance, operation or service, will be free of accidents." P. 478 Out of the Crisis* Of course we should design any system with safety in mind and make a serious effort to eliminate any and all hazards in the designing stage. But we must realize it can never be perfect. Once a system is put in place entropy (disorder) starts.
- Point # 6 Institute On-the-job training. Management has no understanding or use of the thinking of statistical control for safety. Therefore employees are not trained on statistical thinking for safety. Ignorance of statistical thinking is also present when management requires investigation of every single accident not knowing if the system is stable. If a system is stable it is management's responsibility to work on some definite change in the process for improvement (less variation, different level of the number of accidents). "*A manager that understands a stable state knows it is distracting to tell a worker about his mistake.*" P. 126, The New Economics.
- Point # 7 - Institute Leadership in place of supervision. When it comes to management of people the purpose is to help people to optimize the system so everybody will gain. "*We must preserve the power of intrinsic motivation on the job.*" P. 121, The New Economics. Management sets up sophisticated games of "gotcha" to catch employees performing at risk behaviors instead of fixing the system so the behaviors are eliminated or a non-issue when it comes to causing an injury.
- Point #8 - Drive out Fear- "Ranking of people indicates abdication by management." Management advocates teamwork one day and the next day ranks Division's, Department's and even individual safety performance which destroys teamwork and generates fear. The use of safety incentive programs produces more fear and more competition.
- Point # 10 - Eliminate Slogans and posters. Companies still rely extensively on safety posters such as "Your safety is up to you!" etc. believing this shows management's commitment and concern for safety.
- Point # 11- Eliminate management by the numbers and management by objectives. Management sets goals for the reduction of accidents absent any method to achieve them.
- Point # 12 Remove the barriers that rob the hourly worker of pride of workmanship. Management enforcing a policy requiring supervisors and safety staff to investigate every single near hit or miss and accident of their stable system to determine the cause and make adjustments. Resulting in making Mistake No. 1: Reacting to a common cause as though it was a special cause. This is action without knowledge. Not realizing these activities are what Deming called *tampering* with an already stable system. "*In a state of statistical control, action initiated on a defect will cause more trouble." P. 20,* Out of the Crisis

- Point #13 - Encourage education and self-improvement. Management violates this when it sets up extensive programs to have supervisors and peers monitor the behaviors of workers. This is not improvement but a sophisticated game of gotcha.

All of these activities prevent safety managers from identifying and treating hourly workers as *their customers* even though they are the people who are met to benefit from their service. Safety managers are more prone to treat management, outside regulators or certification bodies as customers than workers. They do not understand that Deming's theory and methods cannot be reconciled with traditional safety management. But as he frequently lamented, how could they know? They know nothing else and are too busy or to confident to learn something new.

The transformation of safety management

> "*The only way we can think creatively about a system is to assume it was destroyed last night. It no longer exists. If you don't know what you would do if you can do whatever you want, right now, how can you possibly know what to do when you can't do whatever you want*?" Dr. Russell Ackoff

Traditional safety management is based on constraining people. Meeting safety specifications and maintaining the status quo can no longer be considered good enough. It is time for safety management to practice the theory of continual improvement so safety can be taken to a higher level. This will require a transformation not just a reformation. Reform is about doing things right and transformation is about doing the right thing. Companies point with pride to their safety policy statements proclaiming management's commitment to the safety of its workers. Yet we continue to have safety disasters such as the Sago and Massey mine explosions, the Challenger and Columbia space shuttle tragedies, the Deepwater Horizon disaster, 4-5,000 people killed an over 4 million injured at work every year! We need to distinguish between management's stated safety objectives and its practiced objectives.

Although management may state publicly the safety of employees is its number one concern reality tells us something else. Management's primary expectations of a safety department or safety manager focus on ensuring the company complies with OSHA regulations; implementing some form of behavior based safety; and obtaining safety certifications such as ISO 14001, ISO 18001 or OSHA VPP. (This can be easily verified by looking at Safety Jobs listed on the internet.) All examples of doing things right but not doing the right thing. None will help a company truly achieve continual improvement of safety. The fact is, for the majority of companies managing to meet safety specifications is considered good enough.

But as the noted author Dan Pink says, management is not a tree it's a television set. We invented it and we can change it. Safety management is no exception. Continual improvement of safety requires systems thinking which is sorely absent in command and control. Systems thinking requires discipline. Just announcing you are a systems thinker because you have read The Fifth Discipline is the same a believing you understand American politics after reading a ninth grade level civics book.

With our penchant for analysis we have separated management into different departments; Production, Human Resources, Sales, Marketing, Maintenance and Safety. Each one responsible for handling problems unique to its expertise so each has its own way of viewing problems. This can be very costly to a company because the first department to identify a problem owns it and solves it from its point of view. If someone is injured the safety department is responsible for handling it. The Safety Department solves the problem from its point-of-view. First it tries to simplify the problem which often makes things more difficult to solve. Showing our built-in bias for analysis the investigators break down the accident and ask for input from other departments then determine a root cause. This is a multi-disciplinary team approach not an interdisciplinary team effort. People participate but they don't always cooperate. An interdisciplinary approach involves people from different disciplines working together on an *undivided problem* using synthesis to produce a synergistic solution.

Traditional management believes a system is the sum of its parts. It strives to maximize the performance of each part. But since you can never get 100% out of every part 2 + 2 + 2 can often = 4 or less. Contrast this with continual improvement management which understands a system is the product of the forces between the interactions of its parts. Management's objective is to create a system in which all the parts work well together. In this world the sum of the parts can be greater than the whole so 2 + 2 + 2 can equal 9! Because the objectives are different the results are different. In continual improvement two or more people truly working together can accomplish something they

can't do separately. They can produce synergy. Safety management's objective has been to fix the parts. ***This is solving the effect not fixing the cause***. Its objective should be to fix the system.

The 14 Points: the theory to transform safety management

Dr. Deming's 14 points are a new theory for management. He created them to transform management from command and control to continual improvement to meet the challenges of today's economy. They also provide a theory to help you think about safety and manage it for continual improvement in your operations. The following is an adaptation of his 14 Points directed at safety.

1. **Create a constancy of purpose** of continual improvement of the safety effort in all company operations. If you think employees should be engaged to work on reducing scrap, waste and rework shouldn't they also be working on reducing accidents?
2. **Adopt the new philosophy to manage safety**. Accidents are the worst form of waste in a company. We can no longer live with commonly accepted levels of employee injuries, ineffective safety training, lack of systems thinking and operational definitions of what it means to be safe. Just meeting safety specifications is not *good enough*. Safety management exists to satisfy the expectations and needs of your internal (employees) and external customers.
3. **Cease dependence on mass safety inspections** or any after-the-fact activity to accomplish improvement. Require instead statistical evidence that safety is built in and eliminate the need for firefighting routines that do not change and improve the system. You cannot inspect or audit safety into your processes.
4. **Find safety problems and react appropriately.** It is Management's job to work continually on the safety of the system with the help of the workers. (People, Materials, Methods, Machines, Environment.) Use operational definitions to get the Voice of your Safety Customers into the Voice of the System. Employ the thinking of Statistical Process Control, to determine if accidents stem from "common" or "special" causes in your system.
5. **Use teams for decision-making (consensus) and problem-solving of systemic safety problems.** Systems, even simple ones, are too complex for one person to understand. It takes an effective team to dissolve a system safety problem. Teams require practice to learn how to improve their interpersonal and rational skills for problem solving. Teams with these skills generally outperform individuals. Your organization should learn how to build effective problem solving teams and when to use them to dissolve system safety problems.
6. **Provide leadership instead of managership**. The responsibility of supervision must be changed from managing the safety numbers and setting safety goals and conducting "gotcha" safety activities to being leaders, facilitator's, coaches and counselors of safety improvement. A leader's job is to remove the barriers around workers that prevent them from doing their jobs safely and with pride and joy when doing their jobs.
7. **Respond to systemic safety problems**. Management must create a system that responds immediately to reports from teams on barriers which prevent continual improvement of safety. Use the **Plan, Do, Study and Act Cycle** to study the system and implement change. Work on chronic problems such as; superficial safety training, persistent and consistent accident frequencies, improper maintenance, faulty equipment, unclear operational definitions of "safe."
8. **Drive out fear so everyone can work effectively and safely for the company**. Eliminate the use of performance reviews, behavior observation audits, 0reprimands and safety incentives (bribes) as management tools to control the behavior of employees. Fear destroys intrinsic motivators everyone has to do good work and work safely. Replace fear with a constructive culture where people are safe and secure knowing they can work free from harm.
9. **Break down barriers between departments**. All departments must learn to cooperate with each other so they can work together on dissolving common and special causes of accidents. Using operational definitions of what is "safe" will eliminate barriers between departments, suppliers and customers of safety. Eliminate all activities, ranking department safety records, safety incentive programs, that prevent people from contributing to improving safety in the organization.
10. **Allow process units and employees to set their own safety goals**. Eliminate management set objectives which are put forth in numerical quotas, incentive programs, posters, and safety slogans, none of which improve safety or the system. Management is ultimately responsible for safety and workers must own the safety effort on the job. When it comes to safety give workers the autonomy to set their own safety goals and use the methods described in the 14 Points to achieve them.

11. **Remove any barriers which would prevent the hourly worker from working safely at all times of production and service**. Eliminate the need for supervisors to make choices of Quality vs. Production vs. Safety. All are important and none will be optimized if the other is ignored. Do not emphasize safety one day and ignore it the next. Cooperate do not compete with each other.
12. **Reduce turnover, including internal, and restore intrinsic motivation**. Turnover devastates the quality, productivity and safety effort in all areas of a company. To do a job right it must be done safely. You cannot have high quality and productivity unless you have high safety. It takes time and experience to learn this.
13. **Institute a vigorous program of education and retraining of everyone in the company how to use PDSA and The System of Profound Knowledge to manage safety**. When it comes to safety people must learn how to apply: The customer principle, Teamwork, Statistical Thinking, Profound Knowledge and the Plan, Do, Study and Act Cycle, to safety. Learning these will help people dissolve the safety problems in the system.
14. **Create a structure in Top Management and throughout your organization that will push every day on the above 13 points.**

If you do all of these things what do you think will happen to safety in your organization? These 14 points are the principles required to transform safety management. They are a philosophy of leadership that enables people to dissolve systemic safety problems by applying the PDSA cycle and add to their own understanding about the system. They provide a new theory for continual improvement of safety performance. The System of Profound Knowledge works in concert with the 14 Points to transform the current style of management.

The System of Profound Knowledge (SoPK)

Anyone with more sense than God gave gravel understands traditional management cannot get the best from any system. Most managers still believe the best way to run a company is to have every department compete at its maximum capacity. This is an anti-system thinking and it is wrong. Think about a symphony with each member playing to show off their individual style to outperform the other members instead of playing together in harmony to demonstrate the orchestra's ability. Companies must practice harmony and manage so the system is optimized. This requires a serious change of thinking by managers. If we are going to improve a system we need a way of examining it that simplifies complexity. People will have to learn how to harmonize operations. We must apply Dr. Deming's system of profound knowledge. The following equation will help people understand why we need profound knowledge:

Figure 4 The Lens of Profound Knowledge

$$\mathbf{E\ D = Q_t\ X\ A}$$

Effective Decisions (ED) = (Q_t) The Quality of $_{thinking}$ multiplied by (A) the acceptance of the idea. [16]

Profound knowledge has four different lens to view and study the complexity of a system. Linked together they improve the quality of thinking and the acceptance of a new idea. Profound knowledge will help people transform safety management and make it more effective. The four components of profound knowledge are: [17]

- **A System** – What is a system? How does it work?
- **Knowledge about Variation** – To be able to study and understand variation and learn what it means using statistical theory.
- **Theory of Knowledge** – The ability to learn how to learn by developing a theory to predict what will happen and then testing your theory. Management requires prediction hence the need for knowledge.
- **Psychology** – To study and understand human behavior; how we relate to each other. People have a need to be valued and listened to and be connected with each other. We are learning about intrinsic motivation and how important it is to cooperate with others to improve the system.

The system of profound knowledge combines the analytic and synthetic problem solving tools to achieve *synthesis*. It will give you the ability to observe and develop a new understanding about wholes. You will be able to examine how the interactions of forces between parts of the system impact outcomes. It enhances our creative problem

solving skills to help us examine the structure, order and relations of the problem (Variation and Systems) from different points of view (Psychology) and different levels of thinking (Knowledge). [18]

Dr. Deming cautioned us not be intimidated by the term profound knowledge. Each of us has a different amount of each segment. Increasing our profound knowledge will give new meaning to events, numbers and interactions between people. It will transform your mental model of management from command and control where meeting specifications and analysis is "good enough" to optimization where everyone works to find a better way to satisfy all of your customers. This includes safety customers i.e. the workers.

What prevents the transformation of safety management?

> "*Safety is just a matter of common sense. The problem as I see it is, common sense isn't so common*." Comment by a corporate safety staff member at the company's annual safety meeting.

The quote above reveals so much misunderstanding in so few words. One thing made obvious since Dr. Deming was re-introduced to American managers in 1980 is his theory cannot flourish if the barriers that prevent the hourly worker from having pride and joy is work are not removed. The following barriers prevent the transformation of safety management.

1. ***Paradigm paralysis***: The safety department's management paradigm is the only paradigm. This leads managers into a state of overconfidence. They see no reason to learn anything else.
2. ***Fear:*** Safety managers are afraid to try a new approach to safety. Workers are afraid to bring up issues of safety to management. Fear is perpetuated through many different safety management techniques including safety inspections, audits, reprimands and safety incentive programs. When a safety manager realizes what kind of change and commitment it would take to transform safety in their company they back off quickly. This shows management by fear is alive and working in their company. What safety person wants to be the first to tell management their systems are responsible for 85-99% of the workers accidents? It takes leadership, knowledge and courage to do this. Line managers will not give any power to teams to fix the system, another form of fear.
3. ***Too busy to learn***. The safety manager and his/her staff are just too busy doing traditional safety activities such as: safety inspections, accident investigations, auditing the behavior of workers, safety training, administering safety incentive programs, putting out fires, seeking certification and preparing for re-certification ISO, etc. I wish I had $1 for every safety manager who told me they would like to try this new approach but are just too busy right now. (I personally know some have been too busy for over 10 years now.)
4. ***Unaware of the system of profound knowledge and the 14 points.*** Every safety person I meet tells me they are familiar with Deming and are using his theory. Yet none of them, not a single one that I've met in the last 30 years could tell me what an operational definition is and how to make one! Nor have I ever met a safety manager using SPC charts to identify common and special causes of employee injuries.
5. ***No recognition of the customer principle for safety***. The primary reason most safety programs exist is to meet safety specifications which are company safety rules and safety standards of the regulators. Top management views safety as a requirement not an objective. They cannot fathom the idea they have safety customers whom they serve. When a company truly embraces the customer principle for safety everything about safety changes.
6. ***Lack of autonomy, mastery and purpose for teams to dissolve safety problems***. Until a company gives teams the opportunity to practice team skills, the power to fix the system and authority to spend money to do it they do not have real teams.
7. ***Symptoms being mistaken for causes***. (unsafe acts are symptoms) Managers cannot reconcile the fact they have been misclassifying the unsafe behaviors of workers as causes when they are really symptoms.
8. ***Ignorance about systems***. Managers have learned quality is an outcome of the system. They fail to see that safety is also on outcome of the system therefore management cannot abdicate its responsibility for safety.
9. ***Managers need for examples and instant pudding before they will try something***. They want someone else to do their job for them. This shows lack of leadership even though managers have attended workshops on leadership.
10. ***Reliance on technology and outside experts to solve the safety problems that common sense can't handle***. This shows a lack of faith in people. It destroys trust.

Conclusion

Dr. Russell Ackoff said it is better to do the right thing wrong than the wrong thing right. With its deep ties to command and control safety management's primary focus remains compliance and how to fix the behavior of the worker. I submit this is doing the wrong thing right instead of doing the right thing. Safety personnel still spend the vast amount of their time preparing for ISO certification; conducting audits of employee behaviors and safety inspections to ensure compliance. Because it sounds good and the activities have facile logic to them it is difficult and may be impossible for traditional safety managers to change. In their world meeting specifications and focusing on employee behaviors is correct since their ultimate objective is to maintain the status quo.

From this viewpoint it is easy to misinterpret or ignore continual improvement management theory. Most notably Dr. Deming's 14 Points and his theory of profound knowledge. When it comes to safety the major distinction between command and control and continual improvement is the role people play relative to the outcomes of the processes. In the former when something goes wrong managers assume someone messed up. In the latter the primary suspect is the system. Dr. Deming was one of the first people to recognize most accidents are caused by the system itself not individuals. To understand *why* things go wrong you must examine the whole system. Safety management should embrace the philosophy expressed in his 14 Points so it will be doing the right thing; continually improve the system so the probability people will be harmed while working in it will be minimal.

Safety programs will fail if the people they are meant to serve do not own them. Command and control gives employees no say or a disingenuous gesture for their input about how safety could be improved; eliminating any form of commitment by them. When management can't figure out how to prevent accidents its default action is to push harder on people to follow existing safety rules, regulations or prescribed behaviors. This over simplified approach allows management to believe good safety is just a matter of people using their common sense. To correct this, workers must be given autonomy when it comes to managing safety.

It's important to remember - employees do not start out with bad attitudes and behaviors; the intention of making scrap; getting hurt on-the-job; or lack of common sense. The majority want to contribute to their company in a constructive positive way and have pride and joy in their work. Companies that manage their operations so this can happen outperform their competitors in all important business measures, including safety.

From their first day on the job to their last a worker's performance, enthusiasm and job skills depend mostly on their interaction with the culture, work system and how managers react to problems. Ultimately all of these are the responsibility of management. This doesn't alleviate the need for the individual to be diligent about their personal safety at all times. It does give you a better opportunity to understand why things happen in your system and how to handle them.

As a manager or a safety professional when you *see* a person making a mistake; review an accident report that attributes the cause to human error; contemplate reprimanding a worker because they had an accident or set up a safety incentive program, remind yourself of Salancik's train experiment before you act. Traditional management trains managers to seek quick fixes, results and rewards. They don't take the time to look beyond what is in front of them. In their minds eye the constraints, forces and faults of the work system; the culture and how they handle problems are not important. Essentially they don't even exist so they are free to employ anti-systemic knee-jerk solutions.

The problem affects safety in all organizations from small to large, simple or complex. It creates the worst kind of safety crisis; hazards exist and new ones develop daily but management doesn't know how to respond; the repercussions of which I shall leave to the imagination of the reader. The crisis can be avoided by changing the objectives of safety management from maintaining the status quo, relying on certification and monitoring the behavior of workers to focusing on continual improvement of the system to serve our safety customers. To achieve this transformation safety management must embrace the 14 Points and apply the System of Profound Knowledge.

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