2-2015

Management Challenges in Nurturing a Safe Work Environment

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Preprint 15-076

MANAGEMENT CHALLENGES IN NURTURING A SAFE WORK ENVIRONMENT

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ABSTRACT

As engineers, we are trained to use logical, rational problem solving to insure our mines operate at maximum efficiency. We tend to use the same technical approach to design safety into all mining systems. This works well for machines, but not so much for the human component. Recent insights in the field of behavioral economics provide useful ideas for addressing the fact that we are driven by emotions more often than by rational thought. Understanding the nonrational aspect of human behavior is an important piece of any safety system design.

INTRODUCTION

The most common economic model is based on humans making rational decisions; that given the proper information, we will make a logical, rational decision based on what is best for ourselves (Ariely, 2009, p. *xviii*). In many cases this is an accurate description of how we make decisions. As an engineer, I was trained to apply the precision of mathematics and logic to solve problems. As an engineering professor, I now teach this approach to bright young minds preparing them for a life of professional effectiveness as practicing engineers.

That said, we are not *only* rational. Daniel Kahneman, winner of the Nobel Prize in Economics, describes a model for how we think (Kahneman, 2011). System 1 is the part of our mind that is fast, intuitive, and emotional; while our logical, slower, and deliberative mind is System 2. According to Kahneman's model, System 1 runs automatically, most of what you think and do originates in System 1. System 2 takes over when things get difficult, including the application of math and logic, and the resolution (or avoidance) of conflict.

As engineers, we would typically assume that we operate in System 2 mode most of the time. This is where the model becomes useful, for Kahneman points out two important aspects of the dynamic between the two systems in our mind. First, System 1 has biases, systematic errors that lead to answering questions with an easier answer (rather than a *right* answer) before System 2 is engaged. Second, we can be blind to the obvious, and also be blind to our blindness. Complicating things further, System 1 cannot be turned off (Kahneman, pp. 24-25).

Returning to Dan Ariely, behavioral economics, also called judgment and decision making (JDM), is the study of the emotional aspect of decision making, when humans make choices that seem to defy logic and rationality. In fact, this became the title of his book on the subject, *Predictably Irrational* (Ariely, 2009). We are really far less rational than the assumptions of standard economic theory would suggest, and beyond that our irrationality is often predictable—it happens the same way, again and again (p. *xx*). We make decisions that have a rational veneer, but they originate in an emotional desire for something we crave deep down (p. 53).

Understanding the dynamic of how emotion relates to logic is important when designing and implementing a safety system at a mine. While current approaches to safety stress the importance of each individual in developing a safe work environment, there are particular responsibilities that apply to managers and engineers. An example is the attitude of regulatory agencies.

ROOT CAUSE

There are many reasons ethically and practically to take safety seriously. A not trivial practical reason is the ever-present relationship between operating mines and the Mine Safety and Health Administration (MSHA). We are all aware of the two-page Fatalgrams issued by MSHA to provide a brief description of every fatality that occurs in mining.

What every professional working in mining should be familiar with is the subsequent report of investigation that is issued by MSHA at the conclusion of investigating a fatality. These documents are available to the public on their website. One section of particular interest to managers and engineers is the "Root Cause Analysis" section. This section specifically describes failures by management to prevent the fatality from occurring, beginning the analysis with some form of the following:

> "An analysis was conducted to identify the most basic causes of the accident that were correctable through reasonable management controls" (MSHA, 2012, p. 14).

In this particular fatality, the 11th coal fatality in 2012, a truck driver died when he was ejected from his truck and struck by the truck. A toxicology report revealed a substance in his system which likely impaired his judgment, and he was not wearing his seatbelt. The resulting root cause analysis found four cases where the mine operator (that would be the management and professional staff) failed to provide proper training and instruction that would have prevented the fatality. This finding of failure on the part of management was despite the mine having a current, approved Part 48 training program.

Now, I will readily admit that there are many instances where management is partly to mostly to blame for injuries and even fatalities at a mine site. The point I am trying to emphasize here is that regardless of culpability, management will be the first to be blamed in an MSHA report of investigation for a fatality. Whether it is an explosion at a silver mine (MSHA, 2013) with four root causes, or a machinery-related death at an underground coal mine (MSHA, 2014) with only one root cause, management will be identified as the source of a failure that led to the fatality.

SYSTEM SAFETY

One approach characterizing safety is to view the mine as an integrated system. An approach developed for a research project by the National Institute for Occupational Safety and Health (NIOSH) is a safety system model that contains four components: economics, engineering, work environment, and human factors (Camm & Girard-Dwyer, 2004). This model provides an approach to integrate the insights from behavioral economics into the overall system of a mining operation.

Engineering

Engineering design is a critical component of safety. Large strides have been made in reducing the number of mining fatalities over the previous decades, and improvements in engineering have played a significant role in these lives saved. The proper selection of equipment, work process, mine layout, and maintenance all contribute to the safe and effective operation of a mine.

Economics

A mine must be profitable to continue to operate. From a safety standpoint, not only are the direct capital and operating costs important, but also costs associated with productivity, indirect costs, and intangible costs. Intangible costs include the costs not incurred by a safe operation that avoids injuries and fatalities.

Work Environment

In this model, work environment includes physical agents, chemicals, noise, dust and visibility. Many of these factors are specifically addressed by MSHA regulations, and it is the responsibility of the engineers on site to insure systems are in place to meet these regulatory requirements through work design and PPE use.

Human Factors

Training and work design are key components of human factors in a safety system. In addition, physical capability, perceptual motor skills and abilities, intellectual aptitude, and personality also contribute to the human factors part of the system. Individuals can continue to function in a poorly-designed system, but this will usually lead to increased stress, human errors, and under-utilization of equipment (Chapanis, 1996, p. 19).

Each of these four components interact in an efficient, properly designed safety system (figure 1.).

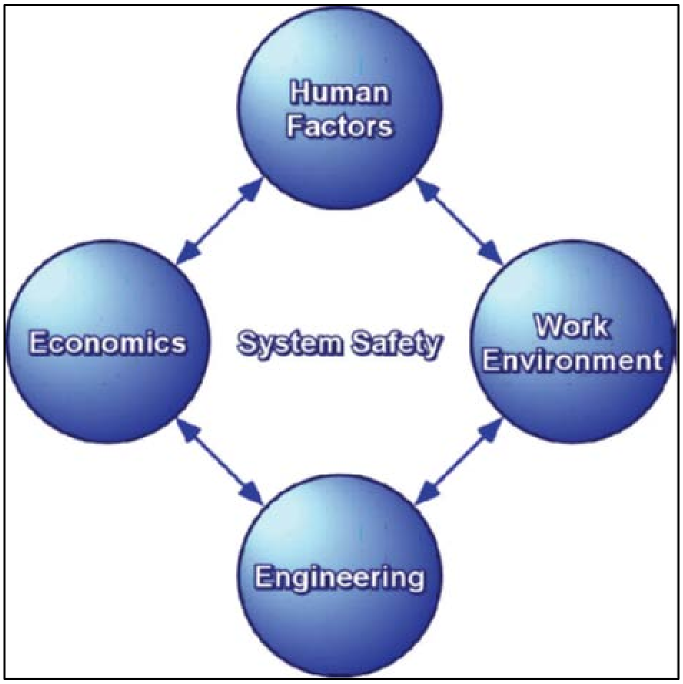

Figure 1. Model of factors used in systems engineering (Camm, 2006, p. 27).

MANAGING CHANGE

One of the dilemmas facing any professional is change management. Humans do not like change, particularly when they are in a system they know and think works just fine. McKinsey & Company, the well-known management consulting firm, has published a series of articles over the years providing guidance in instituting change in organizations. Lawson and Price (2003) outlined four conditions for change at the deepest level—cultural change. This is the type of change most managers seek when attempting to enhance the safety system at a mine. The four steps:

1) **A purpose to believe in**—a compelling story that engages the emotions of workers.
2) **Reinforcement systems**—any new systems, incentives, and processes must be consistent with the change.
3) **Skills training**—companies often make the error of instituting a new system without adequately training workers to fit in the new system.
4) **Consistent role models**—this starts at the top with management leading, but also includes colleagues modelling the desired new behavior.

The Irrational Side

To build upon the model of their colleagues, Aiken and Keller (2009) expanded on the four steps outlined above by addressing the irrational aspects of change management. Human nature often gets in the way of implementing even the best, most logically, rationally thought-out plans for change. First, what motivates you does not necessarily motivate your workers. Second, and related to the first, is that much of the energy spent telling would be better spent listening. This relates back to Ariely and Kahneman, if your workers do not feel a sense of participation in the story of the change, they are unlikely to be emotionally connected to the change. There should be a balance of risk and reward; “we are more willing to take risks to avoid losing what we’ve got than we are to gain something more. Some anxiety is useful when it comes to spurring behavioral change” (p. 104).

Role Models

Conventional managers believe that by acting as role models they can bring about the desired change. While the active participation of managers is important, they often mistakenly believe they already “are the change.” Why is it that leaders often commit themselves to be role models of the desired behavior, and then nothing happens? “The reason for this is that most executives don’t count themselves among the ones who need to change….The fact is that human beings consistently think they are better than they are” (Aiken & Keller, 2009, p. 105).

Any attempt to institute change must be well thought out, logical, and rational. But, it must also recognize that humans do not always behave rationally. It must be perceived by all participants to be worthwhile, relevant to their lives, and fair.

FINAL THOUGHTS

The word *profession* is from the Latin *professus*, which means to affirm publicly. In the past, individuals who had mastered the esoteric knowledge of a discipline had the responsibility to use their power wisely and honestly (Ariely, p. 285). This still holds true today. Every person at a mine has an obligation to operate safely; but it falls on the professional staff of engineers and managers at a mine to insure the design, work process, and equipment fit together in a way to minimize the possibility of an injury or fatality.

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