craig.nelson@vigilistics.com

Using Information to Improve Manufacturing Behavior
Or
The Theory of Recentivity
By
Craig Nelson

The majority of information systems that connect to the plant floor installed over the last two decades have failed to provide the payback promised. They are providing good information, but they don't change the way ***people behave everyday*** while performing their jobs. The only way to cause real return on any project or software for the manufacturing environment is for it to ***change the daily behavior*** of ***people*** or ***equipment***.

Vigilistics, Inc., a California based provider of software for dairy and food plant tracking, Bioterrorism Act compliance, and production improvement information has been conducting experimentation and observation on how information can be used to cause improved behavior in management, supervision, and the general work force. The search was founded to discover if there were common factors beyond good project management, good software, or having a champion in the plant to use the data. While these information project factors are important, they still aren't delivering consistent results.

First, conventional thinking had to be laid aside. A fresh look was needed. Ron Huffman, Vigilistics' Director of Business Analysis stated, "Using information for continuous improvement is an unrealistic goal. Information should help people fix things, and then allow them to monitor them to make sure they've stayed fixed." "Cases where an employee or manager spends time researching reports, trends, or data to find how to improve their operation are rare. And if they are effective doing this, it is a poor use of their time."

Our experiment centered on providing information at different levels that would drive measurable behavior improvement. In one plant the energy usage was measured each day on a spray dryer. At another plant the raw material loss was measured and presented each hour.

Three commonalities were found that directly affected successful behavior change.

- Information has to be recent. (Recentivity)
- Information has to be simple. (Simplicity)
- Information has to be relative. (Relativity)

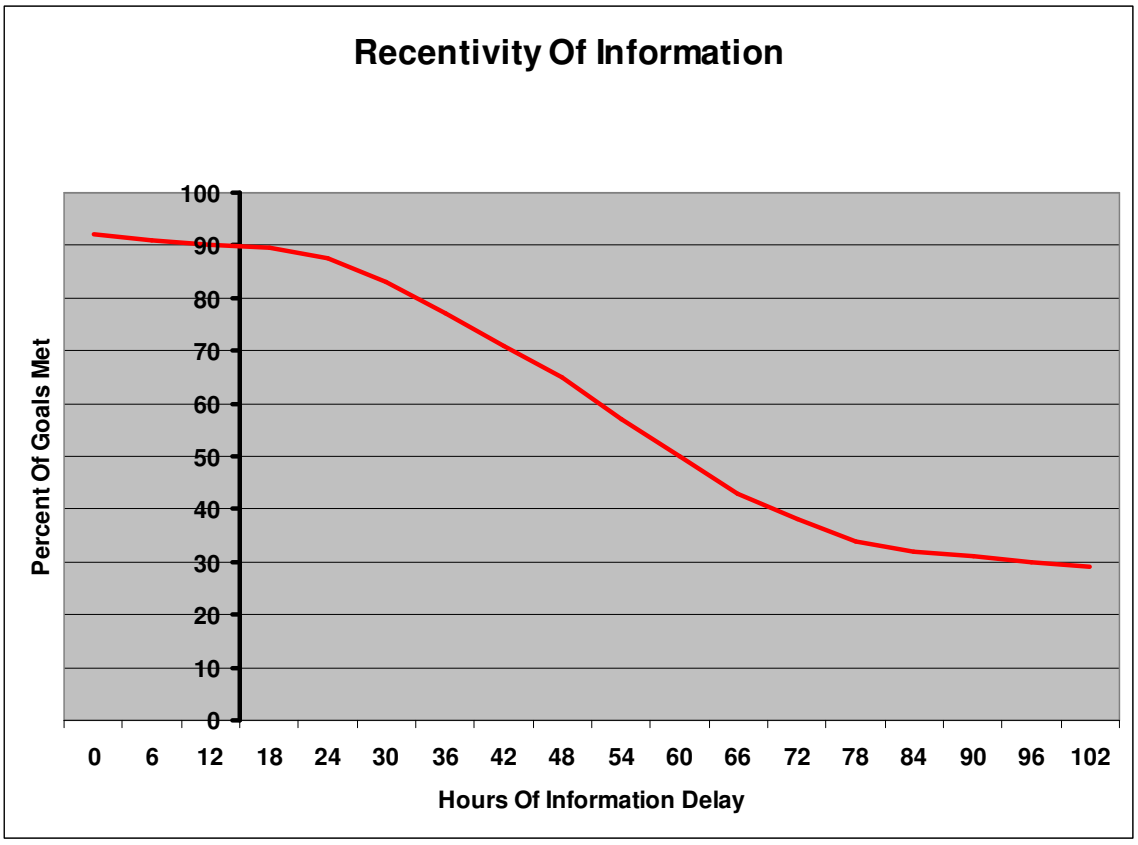
Information has to be recent (Recentivity)

The most important thing is that the more recent the information, the more effective it is to change behavior. This is one of the reasons most accounting systems have a hard time delivering value to plant floor improvement. These typically reconcile once a month. After a month most people will have a hard time remembering what days they worked, much less what they did that caused yields to improve or energy burn to vary from the

norm. Yet when plant operational parameters get out of control, committees are formed to address the problem and the month old information is used to conduct a forensic investigation. Things improve, but not because the cause is understood, but because the problem becomes the everyday focus in people's minds. The meeting, a loss of bonuses or a potential reprimand is the real driver in people paying attention while they are working.

For the spray dryer plant we tried presenting the information that represented their pain every day, which was the consumption of natural gas per unit of product produced. Every morning this ***one*** number was presented. One simple page was attached explaining five states of operation that contributed to the energy burn. This way the operators, supervisors, and managers could view the end goal while remembering what they did to affect the result. In three months their natural gas burn dropped by eight percent.

The following graph shows the affect the delay in time has on the information producing behavior improvement. People are most affected by information less than 18 hours old. Results are good if the results are displayed the morning after, but degrade rapidly soon after.



Information has to be simple (Simplicity)

Traditionally, plant floor information systems gather and display trend and event information that parallels the control points of the production equipment. On the spray

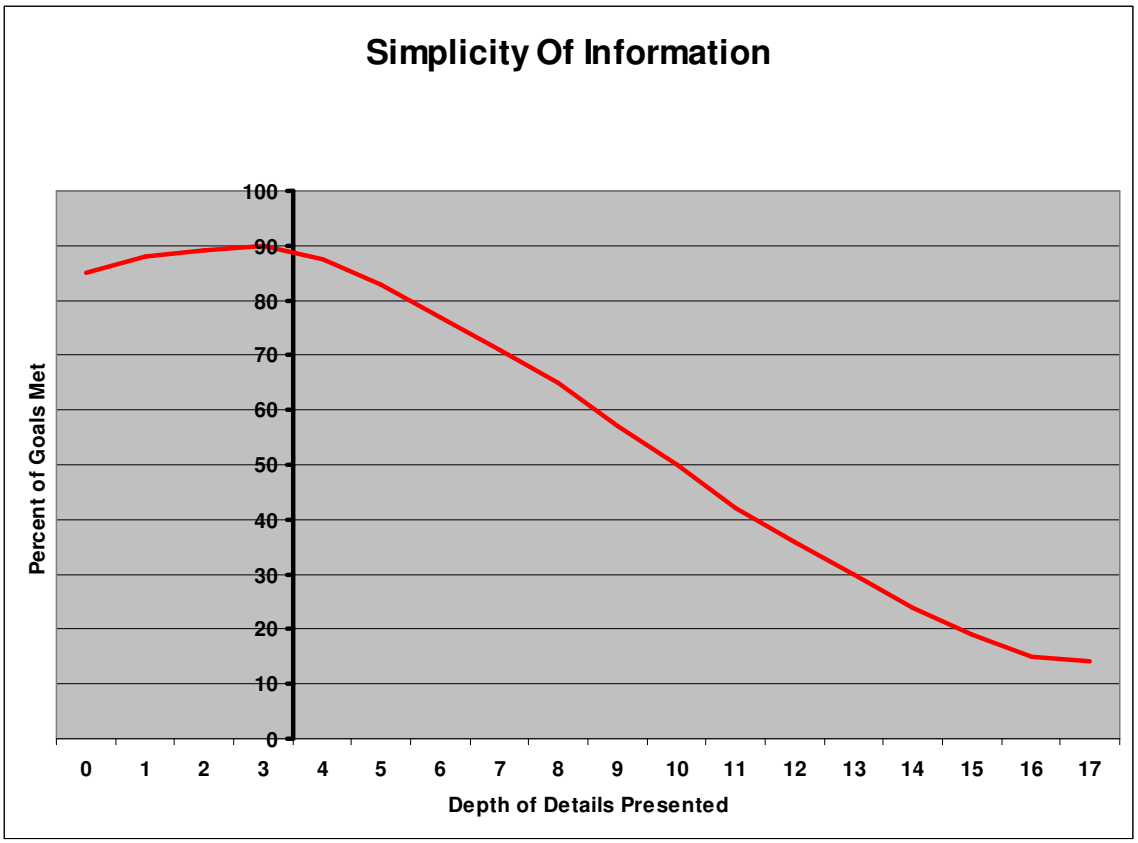
dryer for example, a typical information system would trend chamber pressures, air flows, gas flows, and temperatures. The thought is that if the operators need to control these variables they should be trended and displayed so they can adjust the system to the most optimum performance.

While this is important information and satisfies an engineering mind, operator behavior is affected quicker by focusing on the end goal first. In fact, if there is a choice of which information to view, viewing the end goal will produce better results than the detail information. People will figure out how to accomplish their goals in life if we have the end goal established. In contrast, if we display several points of control without correlating them, the results were less effective.

For example, we displayed only the natural gas per pound of spray dried product in real time, and presented this number every morning to the senior management. Everyone then had the same goal to achieve. Each employee could relate their behavior modifications needed within their specific job responsibility to accomplish the goal of reducing gas burn. The operators figured out how to accomplish the goal, and how to emulate their more successful peers.

It seems that about three pieces of information are the maximum that plant operations people can digest to accomplish their goal. One or two are even better. We were surprised that each operator, supervisor, and manager each quickly discovered what they needed to do to contribute to success. The more detailed information was useful to diagnose problems, but the single goal of gas per pound of powder drove the behavior change.

The following graph show that after three pieces of information are displayed to employees, the effectiveness of behavior change actually decreases rapidly.



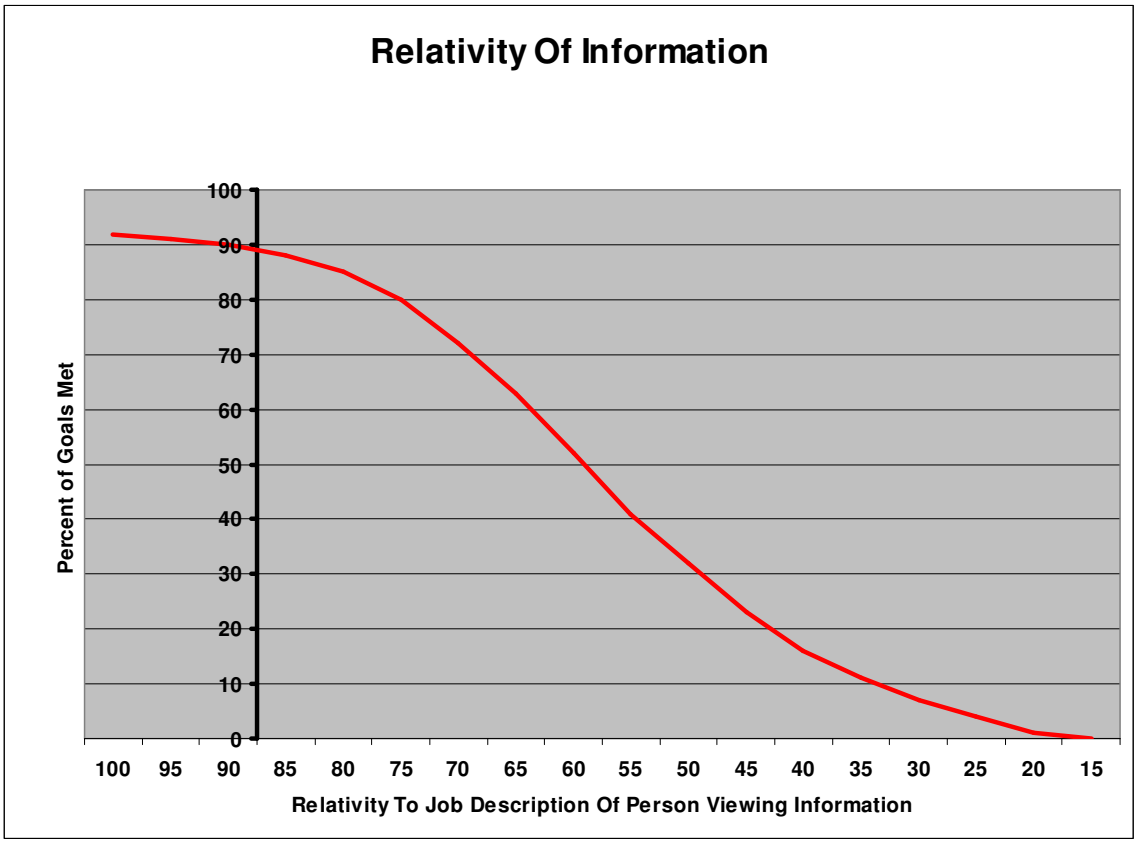
Information has to be relative (Relativity)

Change is most effective when the goal and the information displayed is correlated exactly to what the individual does each day in their job function. Relatively few people are motivated by another's goals. For instance, if the plant manager has incentives for energy reduction and a quality manager's job review is most affected by product yield performance, the goal should be tailored to each, and the information should have the intelligence to evaluate current conditions towards the goal. In a dairy facility, milk loss is typically a huge cost that is hard to control and reduce. Typically when losses get out of control operators and supervisors form a committee to bring the plant back to profitability. Yet the mix or batch operator has no control over raw material receiving, the filling and packaging operators have little interest in waste water, and so on.

In this case we fit the information viewed to each area's job description. For instance in the dairy plant observed, the BOD (Biological Oxygen Demand) of the waste water stream is an indication of the milk loss being discharged. This was displayed to the environmental engineer. Reducing this number meant reducing waste water charges, and better job reviews and bonuses. Filler changeover losses were under the control of the operator in that department, so the reconciliation of product delivered to packages filled every hour were displayed. Receiving operators were shown only the discrepancy between what was paid for on the bill of lading and what was measured into the storage tank. This allowed each operator or supervisor to change what was in their control. The plant management was shown only the rolled up number, or overall plant milk loss. Each

of these was presented every hour, making the information recent, simple, and relative. The result was that milk losses fell by one half, within two months. Everyone was really working on the same goal, reducing waste, but each viewed it from their point of view and control.

The chart below shows a comparison of the percent relativity of the information to the individual's job description. Again the more relevant, the more significant the behavior change seen.



Information systems can deliver big results. Millions of dollars of opportunity exists in most manufacturing plants to improve the process. Technology including connectivity to plant floor hardware, web based reporting, automatic alerts, and database administration has become simple, more reliable, and widely available. Yet often, the information projects still fail.

In seconds from anywhere we can find our bank balance, get directions to any address, and view our homes from space. We use these tools and they have changed our lives because the information is recent, simple, and is relative to the task we are completing at that moment in time. Our information projects will be successful in changing behavior on the plant floor if we apply those same concepts.

Ron Huffman confirms this, “People in manufacturing plants don’t have the time or the staff today to spend reading reports. They need to be able to glance each day at a couple of numbers and then deal with their immediate duties. If the numbers are typical, they can behave the same, and if they’re not, behavior will change.”