THE INTEGRATION OF CONFIGURATION MANAGEMENT (CM), VALUE ENGINEERING (VE), and INCENTIVE PROGRAMS FOR INNOVATION

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ABSTRACT

"Configuration-Value Management" is the integration of three proven management techniques to create a single program balancing control and innovation. (1) "Configuration Management (CM)" is a disciplined approach employed to identify, document, and control the functional and physical characteristics of critical systems. (2) VE is a dynamic team approach that uses economic analysis to add value to products, processes, and just about anything being reviewed. (3) "Incentive Programs for Creativity" boost the creativity levels within organizations.

CHEAP-PLOY-TO-GRAB-ATTENTION

What a terrible nightmare! Your company is going bankrupt and your job is ending. Worse than that, you are being held personally responsible for a release of toxic gas that has injured six employees, people you've worked with for years. They will never be able to support their families again. Everything you have worked for -- your family, your home -- is hanging in the balance

What happened? How could things turn around so fast? Just last week you sent Matthew, your oldest son, off to college, and you received a bonus for having the highest productivity rating in the company's history. The new Total Quality Management program was really starting to work, and your people were starting to shine.

That was before the big accident. A short cut, that's all it was. You saved the company big bucks. It was logical. After all, you're an engineer; you know metallurgy (pretty well). All of those expensive tests and reviews were just slowing things down . . . .

A simple change -- like the one to a safety system in the nightmare above -- can devastate your personal and professional life as effectively as a time bomb. Without control of changes to systems that are critical to your company, things can happen that are equivalent to a sudden explosion.

If the lack of change control can be compared to a time bomb, then the lack of innovation may be compared to erosion. Perhaps slowly, your market share and profits have been eroding away. Other companies may have improved upon your ideas or slowly taken your customers away by redefining product quality. If we haven't tried to increase the value of our products and services to our customer we probably deserve the results.

As the subtitle says this was just a "CHEAP-PLOY-TO-GRAB-ATTENTION." The fact is Configuration Management is a useful tool and VE will make it better.

INTRODUCTION

It seems that whenever VE practitioners speak about the VE methodology, someone in the audience asks how VE compares with other management initiatives. An individual may explain that her firm is using Just-In-Time manufacturing, Kepner-Tregoe problem solving, or Total Quality Management (TQM) to increase competition. The hidden question is, "Why should we use VE instead of some other buzzword from the parade of management fads?" In the same way that one would not use a screwdriver to solve all automotive problems, likewise, management tools and systems require similar logic. In this paper we will answer, in part, the hidden question of comparisons by showing a relationship that can be developed between Configuration Management (CM), Innovation Incentives, and VE. By integrating CM, VE, and Incentive Programs for the creativity that leads to innovation, we can encourage change while we control changes to critical systems.

WHAT ARE THE GOALS FOR MANAGING CHANGES TO PHYSICAL SYSTEMS?

Goals for managing change to physical systems should include:

- soliciting ideas from every available source,
- reviewing and improving ideas that have been provided,
- screening negative changes (especially to critical systems),
- Implementing positive changes, and
- Creating an impartial environment that is full of innovative, happy, involved, motivated, and productive people.

WHAT ARE THE TOOLS TO MEET OUR GOALS?

There are three basic tools we would like to introduce to you for meeting these goals: CM, VE, and Incentive Programs for Creativity. The integration of these three proven management

techniques creates a single program we call "Configuration Value Management (CVM)."

WHAT IS CM?

The term "configuration" refers to the form, fit, or function of a physical system as determined by the arrangement of its parts. The configuration of a production line in a manufacturing plant is the machines, equipment, and systems used, along with the position, function, and physical relationships between each of the items. Critical systems are those which are vital to company issues, such as quality, productivity, and safety.

CM is a disciplined approach to identify, document, and control the functional and physical characteristics of critical systems. CM ensures that out-of-specification changes to the configuration of critical systems are identified, controlled, approved, and documented throughout the system's life cycle.

WHAT IS VE?

VE started as a procurement tool used to identify alternatives to critical materials during World War II. It then became both a procurement and manufacturing tool. The construction industry is following suit and VE is having great impact on that industry.

VE is still evolving; it has entered a new phase driven by a changing business environment. The emphasis today and in the future is on the cost of doing business, time to market, quality products and after-market services.[1] Although the scope of VE applications has changed, the basic methodology has not.

VE is a dynamic team approach that uses Function Analysis and the VE Job Plan to add value to a product, process, or service. VE is not a single initiative, or even a multiple initiative; it is a methodology that embraces all of the initiatives and skills that make a business successful.[2]

HOW CAN A COMPANY BENEFIT FROM CONFIGURTION-VALUE MANAGEMENT?

Each of the systems integrated into CVM has distinct benefits. Other not so favorable attributes, however, can also be connected to them. The integration process provides a check on some of the negative aspects and overlaps possible weaker areas with stronger ones.

		Benefits of CVM
1.	Put safety and quality first	CM
2.	Lower cost	CM & VE
3.	Document changes	CM
4.	Prevent environmental damage	CM
5.	Prevent equipment damage	CM
6.	Prevent litigation	CM
7.	Improve competitiveness	CM, VE & Incentives
8.	Evaluate changes	CM & VE
9.	Satisfy Change Management regulations	CM
10.	Focus on functional requirements	VE
11.	Develop and evaluate innovative ideas	CM & VE
12	Raise value	VE
13.	Improve designs and methods	VE
14.	Increase employee participation	VE & Incentives
15.	Improve innovation	VE & Incentives
16.	Increase job satisfaction	VE & Incentives
17.	Decrease misuse of control systems	Incentives

* For example, CM will satisfy OSHA's recent ruling, 29 CFR 1910.119 on process safety "Management of Change" for highly hazardous chemicals.

One of the potential problems with CM is that creative improvements may be stifled, especially if the CM program is improperly designed or becomes too rigid. As an example, consider the case study below:

A Case of Bureaucratic CM

Problem: A large utility had a CM system that virtually ensured that only the most necessary changes were made. The problem was that the CM program was designed poorly and was unrealistic. The list of critical items was too long. Thousands of systems (some noncritical) were included. Offices and bathrooms made the list. Almost every proposal for change had to go through a technical review board. Too many signatures were required. The change proposal forms that employees had to fill out were extensive, and virtually no assistance was available.

Effect: When changes were requested, response time was too long. Hundreds of change requests were waiting for approval, therefore reviews were not always responsive anad sometimes superficial. No one wanted unnecessary changes, so the department heads fought innovation. Due to frustration, some employees made changes to critical systems without design review.

Results: The results were the equivalent of no change control for some critical systms and almost no innovation.

Even with a well-designed CM system, good ideas at inopportune times may be screened out or lost. VE and incentive programs can help solve these problems. The incentives help to supply ideas and VE provides a design review to ensure that every idea not presently necessary for implementation is recorded and reviewed. The Value Analysis (VA) process improves innovation by providing a structured approach to reviewing ideas. Together, each of these management tools helps to improve the innovation process and management of change in technological environments.

WHERE DO WE START IMPLEMENTING CVM?

There are many "where to start" possibilities. Let's start with top management support. Because CVM requires so much control over critical systems, only top management support can ensure that the resources and priorities exist.

After top management, building the infrastructure to support the systems becomes very important.

- Quality assurance and information management systems are required to ensure quality and to collect, track, and store important documents.
- Numbering systems and archives for drawings will have to exist and be operable. Numbering trees must allow easy access to all related drawings.

- Support Personnel should be available to run the systems.
- Support procedures and policies must be in place, and correct as-built drawings should be required in contracts for work done by contractors or sub-contractors.

Once the infrastructure is in place, the process of building a CM program can start. CM requires discipline, organizational structure, and a systematic CM approach that works the first time. This is important because, with a proper CM program, the stage is set to provide a framework for the integration of VE into the CM process. Incentive programs are used to add a flow of creative ideas and to ensure that some of these ideas make their way to innovation.

The environments within which we place CVM dictate the systems and organizations required. The CVM process must be designed to fit the individual environment and the specific needs of the industry. Environments may include one or more of:

- product design
- manufacturing
- factory management
- computer services
- transportation
- administrative support, and
- publishing

The system should also fit the size of the environment. Small companies require less infra-structure than larger companies. To understand the integration of CM, VE, and incentives, we must first understand the individual systems.

WHAT MAKES UP CM PROGRAMS?

The CM program can be subdivided into four practices:

1. configuration identification
2. configuration control
3. configuration status accounting, and
4. configuration verification.

Configuration Identification (CI) is the set of all documentation required to: design, build, test, operate, and regulate the systems being controlled. CI is represented by the as-built drawings, technical baselines, operating procedures, and document maintenance.

Part of the identification process is baselining critical systems. Baselining refers to the process of ensuring that the documentation reflects the configuration of the physical system. A baseline is established by approval of applicable technical documentation defining the system or equipment at a specific time. Not all systems should be baselined and therefore require CM. To identify the configuratiopns that require CM, we must identify the "critical systems."

To identify critical systems, selection criteria may be used to specify the systems critical to productivity; quality; cost of operation; employee, customer, environmental, or community safety; and company reputation, to name a few. As an example, critical systems as defined by 29 CFR 1910.119 would include processes/systems related to toxic, reactive, flammable, or explosive chemicals as defined and/or listed in the ruling.

The types of critical systems related to the criteria may fall into categories such as management systems, procedures, mechanical systems, production processes, safety systems, products, documents, computer systems, and software.

It is important to review all possible critical systems as candidates for congfiguration control — but don't go overboard. If systems are incorrectly defined as critical, time and money can be wasted controlling unnecessary items.

Configuration Control is the act of controlling changes to the configuration of critical systems. The backbone of this control is the discipline required to maintain control.

If critical systems lists are too large, the CM program can become overburdened as illustrated in the case study. Among the tools used to ensure proper control are change proposals. Change proposals are used to request (propose) a change to baseline of an existing system. Out-of-specification changes to critical systems are not allowed unless change proposals are approved.

The change proposal can be thought of as a package made up of a form and all necessary descriptive documents, drawings, and information required to make a decision on a proposed design change. Several different change proposal uses may be:

- Record a proposed change to the present configurations of a system.
- Baseline the present systems, if there is reason to believe that the drawings, documents, etc., do not reflect accurately the actual configuration of the critical systems.
- Record a proposed change to the configuration of a system that is being developed or built (under contract).
- Record a development or testing phase change. This mechanism is designed for research leading to innovation.

One of the most important paarts of the control process is change proposal screening. Different classes of changes (segregated by cost, down time, safety, etc.) require different levels of review. If decisions are not made at the lowest possible levels, the change control process will also tend to become over-burdened (as in the case study), requiring too much time for important changes to take place.

Priority classifications, such as routine, urgent, and emergency, have profound effects on the time required for the review process. An emergency may require action first and design reviews later. On the other hand, a routinely slow review time could lead to excessive downtime or innovative misuse of the CM process, leading to the equivalent of having no control at all.

In large companies there may be several appropriate parties responsible for screening change proposals including engineers, facility/process supervisors, project/program managers, and technical advisors (electrical, mechanical, industrial, safety, quality, etc.). In smaller companies one or two people may possess all the required resources to screen the proposed change.

VE integration. As we bring VE into the picture, a natural location for VE design review would be in the initial screening phases of the CM process. Furthermore, incentives should be used to guarantee that everyone is motivated to use the control process (firing squads are nice).

Configuration Status Accounting are the processes and systems required to track, file, verify, and audit the entire CM program. In large companies, the status accounting aspect often requires a CM office that may consist of a CM manager, Physical Verification Teams (PVTs), and administrators.

The PVTs physically verify all changes and as-builts to ensure that they have gone as approved and are reflected accurately on drawings and in print. PVTs also examine old systems to ensure that they are recorded accurately. The PVT may be part of a matrix-type organization. This permits the members to change, allowing the teams to be made up of a variety of different mixtures of expertise and experiences. Smaller companies can delegate the required CM responsibilities to other key personnel — for example, the plant engineer may be the PVT.

One of the fundamentals of a good CM program is a strategic placement of key CM personnel (CM manager, CM office) within the conpany's organization. The CM personnel need an adequate level of authority. The position of CM manager may be a staff position. CM under any departmental group (maintenance, engineering, operations, etc.) can, and sometimes does, become controlled by the politics of that group.

Configuration Verification deals directly with the audit processes. Audits of CM systems are required to ensure that records and procedures, as well as time elements, are intact and are being adhered to. Audits of the systems being controlled ensures that:

- as-built drawings reflect actual configuration
- baselines have been updated, and
- implementation has taken place as approved.

HOW CAN WE INTEGRATE VE WITH CM?

An additional step in the configuration control process of CM can be added to funnel changes not required by circumstance to a VE team.

WHAT ABOUT INCENTIVES?

Incentives can be used to boost the creativity levels within organizations. The trick is to provide the right incentives for the people involved.

Someone once said, "What motivates people is what motivates people." Appropriate incentives vary based on the person, the type of organization, the level of employee participation, and the work environment. They are not always financial.

Employee. What incentives can be used to persuade employees (contractors, etc.) to offer creative ideas for the benefit of the company?

Creative people enjoy the process of creating. People often consider ideas they have created, that have been implemented by the company, and later credited to them as being sufficient reward. Ideas related to designed products that bring the company great rewards should, in most cases, bring the individual inventor(s) comparable rewards. A company reputation for sharing profits from design genius with the designer(s) will spread innovation like wildfire — provided accurate records of fair and honest practices are kept.

User or Customer. What incentives would motivate the customer or user to provide useful ideas?

Customers and users are already motivated to help the supplier meet their needs and wants. Good customer relations will benefit the company greatly. Customers want friendly, responsive humans with whom to talk. If customers can provide a design tip that has the possibility of winning a trip or providing income, they will spend many sleepless nights (not on your overhead) researching it. For them, it beats the lottery — for the company, it is cheap innovation.

General Public and Community. What would make the general public respond to a call for ideas?

Every city has talent that can be found in schools, colleges, inventor groups, or creative people. Contests have been targeted at these groups and used to generate ideas in many ways. Inventors have also knocked on doors trying to get some feedback; be open to these people.

To increase Innovation and take advantage of the ideas from employees, customers, users, and the general public several things are required of your company:

1. Easy rules to follow,
2. history of trustworthiness and a reputation for honest and fair practives,
3. an infrastructure to act on the ideas (value engineering screening group, customer service and marketing group, etc.),
4. incentives for the ideas, and
5. good communications.

In general, good inventions require safety and profit for the inventor(s) before the inventor is motivated to part with an idea. A large part of this trust is based on ethics related to good values. Ethics in industry, as well as at home, has many benefits. In both cases it starts at the top. The next step is related to using the idea. Some ideas are useful at first sight; others may never be useful. One of the first steps in using the idea is to apply VA/VE to the proposed design.

The VE team often works well in an environment that allows them to share in the profits of the company. Volunteers may even be used with the promise of delayed rewards. The only conflict here is related to the inventor and the improvers. Everyone must be treated fairly.

Incentives To Use CM. are almost totally negative. However, before you can punish a person for not using the system, you must first ensure that:

1. A system is set up in the first place.
2. The system works.
3. The company is not to blame by unofficially approving such actions (as long as no one finds out).
4. The act was not a premeditated disregard of policy. Someone once put it this way to an employee who made a $100,000 mistake, "We can't fire you now; we spent too much money educating you what not to do."
5. The policy, rules, or procedures are known and used, and
6. People are well trained.

One thing that does not work is unwarranted threats to job security, promotion, or other professional or personal assets. Whenever a manager uses poor management techniques like this, she/he is at risk of legal action or at least losing the trust of otherwise good employees.

CONCLUSION

Managing change is required to ensure quality, productivity, safety, innovation, and competitiveness. The key to control is a well-organized CM system. The CM system should provide suitable checks and balances so that required changes can be made in a timely manner. CM is done (organizationally) outside the group proposing a change, but should be screened at the lowest levels, which may be inside the group.

Control is half of the picture; the other half is innovation. Innovation requires creative thought and can be improved by using the systematic approach of VE. VE is an organized method of ensuring a structured approach to the thought processes required to add value to a process or system. However, ideas should also be solicited from outside the VE process. People want to contribute ideas, and sometimes only the motivation and infrastructure to do this is missing.

The integration of systems, infrastructure, and motivation required to manage change is what we call Configuration-Value Management.

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