CONCURRENT ENGINEERING THE PROJECT MANAGEMENT WAY

By Robert V. Sweeney
and Jim Frakes

INTRODUCTION

A recognized need to implement, enhance end improve efforts toward concurrent engineering spans multiple industries. The shift toward a global economy only increase the level of competition that any company, in any industry, in any country, must contend. Because of the competition, shorter product development cycles are crucial to survival.

Concurrent engineering might be characterized as the process by which a number of components or parts, that comprise a common system are simultaneously designed and developed, and effectively come together to forma whole, functional system or product The desired benefit of this approach is a well-engineered, quality product that can be smoothly produced in a compressed time frame.

To accommodate a reduced time frame, there is a great emphasis on getting the "functions" Of the organization together early in the development of the product. These functions typically are engineering and manufacturing, but might also include quality, finance, and purchasing. Ideally, the product and process design for the product will be established and "frozen" es early on in the product's development es possible. This way, the concurrent engineering and design activities may work successfully to the desired end (a quality, buildable product). While it sounds simple, the complexity of the product produced, as well es other variables, affect the quality of the end product.

To ensure that qualityis established throughout the product development cycle, many tools are used to maintain the technical integrity of the product. FMEA (Failure Mode Effects Analysis), QFD (Quality Functional Deployment), DFM (Design for Manufacturing), and DFA (Design for Assembly) are all tools that help in building quality into the product, throughout the development cycle.

Concurrent engineering may be thought of as the technical side of the product development process. The idea is to do as many things es possible in parallel, at the same time ensuring that "quality" is being built in. While the technical aspects of the product are being managed, are the "business" aspects of the product being managed as well?

If indeed time is money,then any change to a given product is costly. The time needed to make the change, and the time (value) lost in bringing the product to that point in development. Design time, tooling, machinery, end other parts on the product are areas that will consume more time and materials, so that the costs increase exponentially (Fig. 1). While costs can be a driving factor, the timing schedule, availability of resources, end the inherent technical aspects of the product are interactive variables that affect each other.

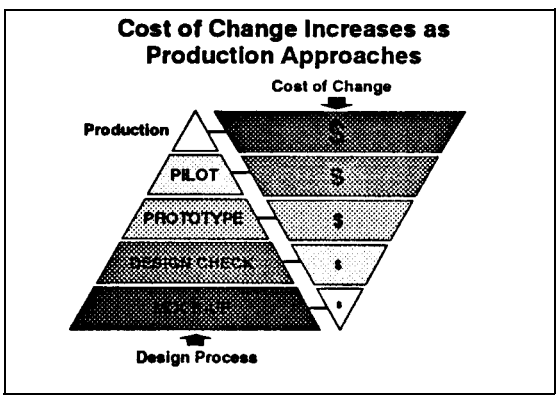


FIGURE 1

Project Management plays an important role in concurrent engineering, In fact, a case can be made that Concurrent Engineering is Project Management. Project Management might be described es a clearly defined sequence of related activities designed to accomplish the end product of a work objective, using a predetermined set of methods end techniques that span the planning, organizing, controlling end evaluation of a program. However, this technical definition cannot be limited to the widely known "tools" of project management (Gantt or bar chart, work breakdown structure, network diagram) if the discipline is to be successfully used. Rather, project management must be expanded and broadened.

Efforts to implement concurrent engineering often center on redefining the organizational structure, or vital functions inside en existing organizational structure. The intent is to get the organizational functions "communicating" from the beginning of the product development process. An example of this cross-functional approach to developing a product would be getting the engineering and manufacturing functions communicating. This approach results in more effective input into the technical aspects of the product, es well as the process by which that product will be manufactured, from the onset. Isn't if curious that these same elements are traits indicative of en effective project management environment?

Concurrent engineering approaches end accompanying tools can result in some improvement in the product development process, but how would one know? How would one measure success? A project management approach has the needed measures of time (schedule), costs (budget), end resources (manpower end facilities) that need to be built-in to concurrent engineering efforts. Good business decisions which are inherent to the internal workings of en organization can be made throughout the development process, end measured at the end to determine a level of success. Without the accurate measures that result from a project management approach, any gains in quality or productivity from concurrent engineering efforts can only be inferred.

WHY IS INDUSTRY FINDING IT SO HARD?

HOW ORGANIZATIONS ARE STRUCTURED

The need for concurrent engineering, with the intended end being shorter product development cycles, is particularly acute in the American automotive industry, Companies related to the automotive industry find it difficult to compress the new product development cycle. Some efforts succeed, but overall, considerable room for improvement exists.

A basic problem is not so much the structure of organizations, but rather the way roles are defined end reinforced within the structure. Most organizational structures maybe typified as vertical (Fig. 2). The vertical, or functional lines of demarcation and responsibility, are typical organizational structures. The problem evolves from the fact that power, politics, and reinforcement travel vertically, which is in contrast to the lifeline of a typical manufacturing organization.

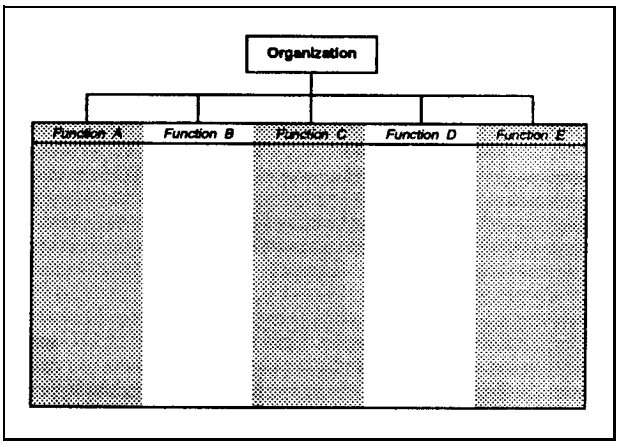


FIGURE 2

Most manufacturing organizations are *project-driven.* By project-driven, we mean that the life of an organization relies on it's ability to develop desired products for the marketplace, efficiently bring them on-line, and produce them *to* desired specifications. The inability to develop the desired products, or manufacture them in an efficient manner, will inevitably result in the decline and possible and of the organization.

when an organization is project-drlven, concurrent engineering and project management obviously make sense. However, conflict arises because projects flow *horizontally* across an organization (sea Fig. 3), while the power, politics and reinforcement flow *vertically.* The emphasis lies in the vertical functions of an organization. The emphasis on the "lifeline," (the ability to develop and manufacture desired products for the marketplace), whether we call it concurrent engineering or project management, is minimized, even handicapped.

CULTURAL PROBLEMS

Another factor that has lead to shortcomings in American industry is the American culture.

In America, we take great pride in the value of the individual. Often this is in opposition to the group or team. This has been a recognized problem in industry, and is not a new concept. American industry has been looking at Japan and beating itself on the head for over ten years, while trying to implement "workteams," "quality circles," and "self-directed workteams." Generally, American industry did an excellent job of forming the teams. However, maintaining end reinforcing the teems, end providing them with a purpose or structure *to* work within is where American industry falls short.

By forming teams, many organizations thought that quality improvement, increases in productivity, and better employee morale would automatically fell into place, for the fact that the teems exist. It does not. The simple laws of behaviorism dictate that

- When a behavior is reinforced, it increases the likelihood of that behavior occurring again,

- When a desired behavior fails to be reinforced, it decreases the likelihood of that behavior occurring again.

Most teams identity defined outcomes or are aware of intended outcomes. The reason so many "team" approaches faili is they lack a defined process or reinforcers for group behavior. If the group behavior is not recognized or reinforced, it extinguishes itself over time. The enthusiasm that initiates such efforts gives way to cynicism and despair, rendering the group helpless (i.e., "Nothing we do gets recognized. They never act on our recommendations, so why are we doing this?").

PEOPLE'S ATTITUDES IN ORGANIZATIONS

Another American trait that inhibits the success of concurrent engineering and project management is the lack of value placed on planning. Our culture is full of phrases like: “American know-how,” “Nothing replaces hard work,” and the popular phrase borrowed from a sneaker company, “Just do it.” Noble efforts to implement project management and concurrent engineering are met with, “We don’t have time to plan.”

We love to implement and execute in America. We’re great at it! However, it is precisely because of the lack of planning that most organizations indicatively menage by *chaos* as opposed to menage by *control.* Product development receives the most attention (and, subsequently, the most resources) the closer the production data gets. Resources (manpower, equipment, facilities) are literally thrown at projects (Fig 4). This habit can be attributed to a lack of planning on the front end of the product development process. Don’t most organizations went to exert control over the very elements that maintain their existence? Quite simply, without a detailed plan, organizations are at the mercy of their programs end projects, the “lifeline” of their being.

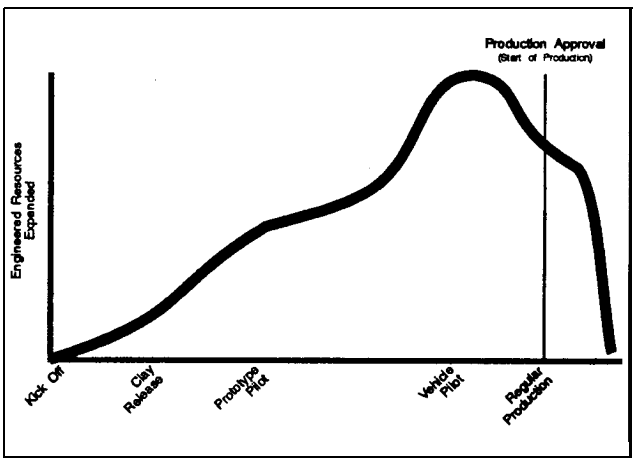


FIGURE 4

MANAGEMENTS MISCONCEPTIONS

Any number of organizations see current technologies and pursue them aggressively. Concurrent Engineering, Project Management, Total Quality Management, Total Preventative Maintenance and a host of others are all initiatives that organizations actively pursue to better themselves. Orders are decreed from the executive level of the organization, and management is tasked with making it “happen,”

Management, with all the good intentions of making the initiative "happen," unintentionally may do more harm then good, due to the false belief that, “If I give my people what they need, they will be able to do it.” So, managers may train all of their people in a technology, end invest considerable money into computer hardware and software. ***And it doesn’t happen!*** Management sits back and assesses what has occurred: “I’ve given my people everything, why don’t they just do it?”

THE MISSING LINK

Some broad problems have bean identified and discussed with respect to why American industry has found it very hard to implement concurrent engineering with project management. The missing link to implementing these, as well as any new technology or discipline is: while employees may have the skills to use a new technology or approach to business (through training), end may have the tools to do it (computers and software), there is no context in the organization to use these skills and tools. More concisely, there is *no organizational process in-place* in which the employees can use the skills and tools.

Another phrase we often hear in America, is that there is "no greater teacher than experience." This being the case, it is probably worthwhile to examine a Case Study of Cummins Engine company. Cummins is a large company that saw the linkage and need to implement concurrent engineering with project management. Their initial experience was typical of what many organizations experience, but their subsequent strategies are things that many organizations can learn from.

CASE STUDY - PART I

Cummins Engine Company is recognized around the world for excellance in the design and production of diesel engines. However, throughout the 80's, there had bean consistent pressures *from the* marketplace end worldwide competition to improve the development and introduction of product improvements and/or new products.

If competition, quality, and economic conditions weren't enough, there were also the environmental regulations being legislated by the U.S. Government. These regulations are constantly getting tighter end more stringent with each passing year. With each change, target dates to accomplish fuel economy or emission standards were consistently moved up. Obviously, the need for more effective concurrent engineering and project management was critical.

New technical and quaity systems ware introduced and implemented at Cummins as well as *a* business strategy to reduce cost in a very competitive worldwide marketplace.

Cummins viewed concurrent engineering as a critical strategy. They simply had to reduce the product development cycle time, while building into the product the quaility that Cummins had come to be known for. Cummins embarked on a strategy that they hoped would enable them to improve the timeliness, costs, and quality associated with introducing new products to market.

A CALL TO TRAINING

Unlike any number of other organizations, Cummins recognized the need for a project management component to compliment their approach to concurrent engineering. Together, it was hoped, they would work in concert with their Cummins Production System (CPS), Total Quality Systems (TQS), and Cummins Technical System (CTS).

Cummins formed a Project Management Steering Committee to help guide the development of a project management process. Recognizing the need for expert input, the committee embarked on surveying possible training and consulting companies to supplement their efforts. A competitive analysis was done involving several training and consulting organizations, and in the end General Physics Corporation was awarded the contract.

Cummins and General physics agreed the first step should be on-site interviews with members of management and key project personnel. The purpose was to glean information on the organization, how projects were currently run, perceptions on how they might be run, and how knowledgeable personnel were of the technical systems Cummins was trying to implement. After the interviews, General Physics would tailor their training to reflect the information gathered, and subsequently run a pilot class.

The steering committee at Cummins had constructed specific objectives for themselves, and for General Physics as well. Throughout these initial activities, General Physics continually brought up the issue of *defining the process. This* emphasis was driven from the up-front interviews General Physics had conducted.

In the October of 1990, a pilot class was held. This pilot class was composed of three project teams from the 1994 Heavy Duty Engine (94HD) product line, and the fourth wee the committee implementing project management. The three teams worked on projects concerned with the 94 Heavy Duty product, while the committee's project for the class was how they were going to implement project management.

TRAINING AND ISSUE ANALYSIS

General Physic's approach to pilot courses was to combine the GP generic project management course with an "issue analysis" component. After lecturing on a concept, and *assisting* the class through an exercise, the class participants would apply the concept to an actual project in-class. Subsequent to this, outside the running of the standard *course, en* instructor would ask the participants questions around each project management concept presented. An example of these questions might be:

- Can you apply this concept in your organization?
- Is there a tool your using now that this concept can enhance?
- If you can't use this concept in your organization, why not? What is preventing you from using it? What are the barriers?

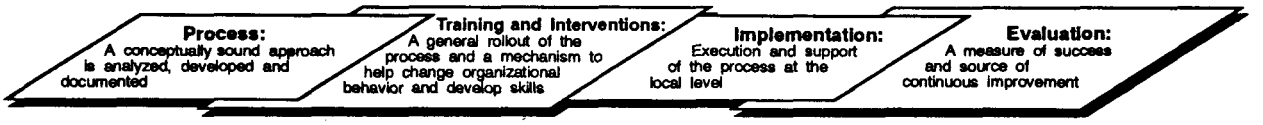
Responses to these questions were recorded throughout the conduct of the course. When problems or barriers were recorded ("issues"), participants were then asked to respond with their recommendation to address the issues.

At the end of the class, participants were asked to rank what they felt were the top 5 issues in the organization ("5" being most critical). Participants were also asked to rank the top five recommendations, in a similar manner.

Implementing the issues analysis approach during training produced many emotional responses from class participants. The individuals at the end user level were both frustrated end confused with the current new product introduction process. Class participants truly wanted to do their job batter, and wanted their organization to succeed. It was the organization itself, however, they felt wee limiting their beet efforts end intentions.

At the end of the pilot, Cummins management concluded that the management process must be defined prior to further training, It was very apparent that giving the employees the skills and tools was not enough, A specific map of how the tools and skills were going to be used had to be painstakingly mapped out.

This effort, as well as years of experience end frustration, resulted in the development of a "Strategy implementation Model." While the model evolved out of the efforts at implementing project management and concurrent engineering, the principles are generic enough to apply to any new strategy that en organization wishes to implement.



THIS ENTAILS

- A complete action plan for design, development, rollout, and evaluation of your process
- Technical approach is conceptualized, researched, developed, and tested
- Gaining senior level and end user sanction and acceptance
  - Project Management signoffs
- Defining linkage to other key strategies
- Documented job aids, tools, procedures, software targeted to support end users' needs
- Strategies to overcome potential human, organizational and technical barriers to successful implementation
- Profiliing the target population
- A sequence of appropriate training and developmental activities: e.g., curriculum
- Designing and developing training materials and "structured learning experiences" integrated with the process documentation
- Structured preparatory activities prior to classroom or "Learning Lab"
- "Learning Lab" and classroom activities relevant to real job responsibilities
- Senior Management reinforcement
- Local implementation of corporate direction; e.g., on the job activities
- Follow-up support, coaching and guidance after the training; e.g., catalyst function
- Methods to share lessons learned, and a process to promote success stories
- A catalyst function to drive and nurture progress
- Defining a progressive series of goals that help measure progress over time
- Measuring results against initial target goals
- Defining any limiting factors and their root causes
- Methods to systematically improve the process, training, and implementation approaches

THE STRATEGY IMPLEMENTATION MODEL
FIGURE 5

"It takes a considerable amount of work to make something simple, and no work at all to make something difficult."

PROCESS: ***a conceptually sound approach to doing business.***

Action Plan

The emphasis in using concurrent engineering with project management is to effectively plan end execute new product introduction. To effectively plan the rollout of this "new approach to doing business," an *action plan* must be developed to ensure some degree of success. Ideally, this action plan should be mapped out *using one of the methodologies being implemented - Project Management!* Thus the group of individuals steering implementation is using project management to implement project management and concurrent engineering. This not only makes logical sense, but to the population that will be affected by this new approach to business, the implementors of the new process will be "walking the talk."

Action items:
- Establish an Implementation Team
- Build a project plan and a "notebook"

Technical Approach

Many approaches, some with common traits and others with distinct differences, are promoted to implement project management and concurrent engineering. These traits may or may not compliment the current systems/processes in the organization that are working well. It is crucial that the approach taken be molded and blended with the "good" things the organization is doing.

Action items:
- Research any number of approaches
- Have cross-functional teams modify and apply a suitable approach

Sanction

Efforts to bring about organizational change will not succeed without Senior Management sanction. With a little education, end users can begin to redefine the way in which they want to do business, end have enough information to effectively brief senior/upper management. This way, buy-in can start at the end user level, and sanction can be won from the members of senior/upper management.

Action Items:
- Select and brief senior level management
- Select end brief end user sanction groups

Linkage to other "Key" Strategies

In many organizations, key "strategies" or "initiatives" are pursued, but few ever come to fruition (i.e., a recognized benefit for having pursued the strategy or initiative). A major reason for this is that end users, the people that the strategies are supposed to help, end up with a "juggling mentality." That is, end users wonder which strategy they should use to better do their job. This often is dictated by the politics of which executive or manager in the area of the organization is the "champion" of which strategy.

The key is to effectively identify and integrate common traits linkages between the strategy being pursued and the current process/systems already in place. Integration end process definition occur instead of the frustration end users experience under the "juggling mentality".

Action Items:
- Identify what specific took in concurrent engineering should be mandatory inclusions in any project plan.
- Appoint a small committee to establish linkages between current systems/processes end the new technology being introduced (in this case, concurrent engineering with project management).

Create End User "Tool Box"

To introduce and "upstart" end users into using project management or other technologies, they must have the direction, sanction, reinforcement end tools to begin with. People are naturally resistant to change, and with the introduction of en organizational change, they (particularly end users) are fighting habits (good and bad), that have been reinforced for years, maybe even all of their professional lives. It's critical that every opportunity be taken to enable them to succeed.

The "tool box" may be thought of as a number of took and job aids that let end users easily access the direction and information they need to implement the new technology. Procedures, templates, reference guides end software might be incorporated into a tool box.

One word of caution on software. Too many companies become preoccupied with the vast array of software available, particularly project management software. There are over 120 project management softwares in existence, Too many companies have the software, but neither have the skills (engineers make pretty pictures - bar charts - of wish lists of things to do with dates attached to them) nor the *process to* use the software effectively. Remember, if computers and softwares are thought of es *systems,* the *process (the* approach to business) enables the end users to effectively use the system, not the other way around. If reversed, effective project management and concurrent engineering **cannot** occur. The work that results in a desired product is still accomplished through **people.** Without the *process by which* people will do their work, the effectiveness of a system is minimized.

Action items: ● Have the committee that is developing the process conduct interviews/surveys of end users.

● Have committee (or subcommittee) look at project management needs of the organization, and contrast this information with a survey of software and capabilities.

● Synthesize and filter information obtained.

● Brainstorm and initiate development of tools and job aids.

Anticipatory Strategies

The development of anticipatory strategies is another critical factor in the successful development of an effective project management process. These "plans within the plan" or "contingency plans," are needed to overcome expected (and inevitable) barriers to implementing concurrent engineering end project management.

These barriers are inevitable, thus specific plans should be laid out to overcome them. People are naturally resistant to change, thus some thwarting behavior and cynicism (defense mechanisms buffering individuals from participating or "buying in" to the change) is going to occur. Some of this behavior has to be tolerated, but at the same time too much can be the death of implementation.

The barriers may be very predictable and generic ("Design staff never wants any timing or cost constraints imposed on them"). More specific, subjective barriers to implementation may be the politics of the organization, or the personalities of key members of management.

Action items: ● Analyze the organization.

● Brainstorm on potential barriers to successful implementation.

● Rank barriers in order of most critical to overcome (i.e., those that would most handicap implementation efforts).

● Create strategies/contingency plan

TRAINING: ***A general rollout of the process and Project Management, as well as mechanisms to help change behavior and develop skills.***

Development of a Curriculum

A curriculum, which is a series of appropriate training courses, should be developed so end users, as well as peripheral project participants (purchasing, quality, finance), can attain the skills they need to fulfill their roles on a given project. Before courses are surveyed, however, an analysis of the process and prerequisite skills needed for various participants to function in the process, must be executed. Otherwise, considerable money may be spent on training that is not appropriate, or worse yet, will teach the wrong skills, to the employees of the organization.

Action items: ● Analyze the skills needed to effectively function in the defined project management/concurrent engineering process, versus the current skill sets of the target population.

● Filter out the needs (or skill deficiencies of the organization), and rank what desired skills are most important to overall success.

● Decide what mode and level of training would best address the most critical needs.

● Do survey of potential training resources, internal and external to the organization.

Integration of Training Materials and Process Documentation

In training, concepts and skills are taught in the hope that an employee will use the newly learned skills in the workplace. It has been established that a process will help facilitate use of the new skills. Incorporating experiences (in implementation), process documentation, and procedures enables the learner to specifically make the linkages between the newly taught concepts, the documentation, systems, and processes the learners are already familiar with.

Action items: ● Survey current process documentation and procedures

● incorporate, where appropriate, the process entities into the training materials

Structured Activities Prior to Classroom or "Learning Lab"

Training marks the occasion the desired skill set is presented, and, hopefully, new behavioral repertoires are established. Again, however, the issues around "change" can be restricting.

Even when target populations are "sold" on an idea or concept in training, "buy-in" (the willingness to use these concepts on the job) may not occur. This applies to either the end user or management. What is needed to overcome this barrier are some preparatory activities that will enable management to manage by the "new way of doing things," end that will allow the end user to willingly use the new skills back on the job.

Action items: ● Construct preparatory activities for management to ensure they will support sending their people through the training, and will allow them to reinforce their people for using the new skills.

● Build preparatory activities for end users so they are "ready" for training (change), and are as well prepared to commit to buy-in.

● Build the training to simulate what will be done back on the job, This way, classroom activities are directly relevant to real job responsibilities.

IMPLEMENTATION: ***implementing Concurrent Engineering and Project Management***

Senior Management Reinforcement

The end user may have a host of new skills they are expected to use on the job. Indeed, the end user's role has changed. Management's role has changed es well. While a manager may not need a "hands-on," functional knowledge of project management, they nonetheless must have enough knowledge of the subject to effectively menage the new type of information they are being given. After all, it is management's job to interpret and make (sometimes very hard) business decisions based on the information their people give them.

Too often when engineers use the project management approach in their jobs, they are actually punished for using the vary skills management supported. When this occurs, project management implementation starts to fail miserably. Managers have to learn to manage by the new approach and reinforce usage no matter how disastrous a given project may get.

Action items: ● Administer training to management that briefly covers the core methodology of project management, and that specifically delineates management's roles end responsibilities in managing through it.

● Modify organizational guidelines end procedures to reinforce and give direction to managers concerning the 'new way of doing business."

Local Implementation of Corporate Direction

Pilot efforts to implement project management and concurrent engineering are advisable. When tying anything new, starting small ensures better, long lasting success. The core issue here is control.

If organizations want to implement project management or any other technology across a company, all at once, control is minimized. When implementation starts on a smaller basis, feedback is more direct and timely. This enables those individuals trying to implement the new process to respond quickly, subsequently document the problems and tweak the process as if rolls out to larger audiences.

Conversely, when such efforts are done on a "company wide" basis, impending doom always lurks. When things go wrong, feedback is not direct, response is latent, and frustration sets in on the end user, Once this starts, the likely outcome will be people abandoning usage of the new approach (i.e., "It doesn' twork!"). No matter how much people went the new process to work, if the masses are frustrated, it will be abandoned.

Action Items: ● Ensure jobs are structured to incorporate the new processes. This would entail job descriptions, performance reviews, and the standard meeting cycles (project reviews) that occur. If there are no expectations stated in the organization, there is nothing to fulfill for the end user (Le., there is no reason for engineers to change the way they do business).

Catalyst Function

The catalyst function may be described as support, coaching, mentoring, and guidance after training. This function may be served by "internal consultants," or consultants hired from outside the organization. Unfortunately, few organizations recognize the need to invest in this critical function full time.

When trying anything new, the chances of getting it right the first time are slim. People, when faced with a failure or shortcoming when trying something new, often quit (the behavior is not reinforced, so the behavior is no longer emitted). Even when people try something new end succeed, when chaos end stress set in, they revert to old habits (they go back to the behavior that has been reinforced for years). The catalyst function is designed to be part of the "reinforcement" for end users, to encourage, guide and refine attempts at using project management techniques while functioning in a concurrent engineering environment.

When people attempt something new, it is virtually impossible to have "all the answers"; this cannot be trained or taught. Marty people, when they are at a crossroads and need assistance, will construct elaborate mechanisms to insulate themselves from potential criticism for not "knowing; even though no criticism may be coming. The catalyst function, the full time, dedicated experts, are thereto answer the public or private questions, and short circuit "defense mechanisms." This enables end users to overcome frustration, insecurities, and conflicts.

Action Items: ● Appoint, hire or contract with qualified coaches and mentors (consultants) to reinforce, educate and assist people using the new process.

● Define the roles of reaches/mentors, so they cart additionally run interference when politics and conflict evolve. Also define their evaluative role, as use of the process increases in usage.

Methods to Share Lessons Learned

There is a strong need to share successful approaches, as well as failed efforts, to successfully implement project management and concurrent engineering. Corporate culture too often results in shortcomings being swept under the rug for fear of embarrassment and successful approaches being concealed so as to not give away the secret formula. But since a "team"approach to implementation is a prerequisite, those who implement concurrent engineering with project management must devise schemes and avenues where these occurrences cart be showcased and learned from.

On the level of en end user, the need for this is critical. Things that go well will reinforce themselves, so the end user is likely to repeat that behavior or approach again. When things go badly, it is thought that likewise that behavior will not occur again. But what if the end user doesn't have an alternative response (behavior)? By pooling information from the end user level, approaches can be shared, compared, and contrasted, hopefully resulting in recommendations to refine the process.

Action Items: ● Develop an accessible 'Lessons Learned Database."

● Institute a "Project Newsletter" for the organization.

● Use Electronic Mail to update specific populations of employees on the approaches and techniques.

EVALUATION: A *measure of success and source of continuous improvement*

Methods to Improve the Process

The spirit of continuous improvement, *kaizen,* dictates that there is always room for improvement. The four major areas of this "Strategy Implementation Model" (Process, Training, Implementation, Evaluation) are not iterative steps, but rather they are inter-related. Because of these interrelationships, methods to systematically improve the four major areas should be built into the process as soon as the process starts developing. When this occurs, continuous improvement strategies are built into the implementation of project management and concurrent engineering from the beginning, and ensures a consistent feedback loop throughout the execution of the four major areas of the Strategy Implementation Model.

Action Items: ● Have user groups meet on a regular basis to discuss approaches.

● Document the process by which feedback is given and followed up on.

● Document and communicate the evacuative role of the catalyst function.

Measure Results

Merry new product development efforts have been dubbed successful, when success was never really met. Often, the efforts made at the back end of the project, before production, are so hectic, chaotic, and emotional, that getting the product out the door was the success. The product may or may not have met technical specifications, may have been over budget, and/or may have been late, but the relief of getting it out of the plant makes all participants feel good about their efforts.

The goals of organizations parallels that of concurrent engineering with project management meet all product requirements, maintain budget, and meet the customer's schedule, A successful project should meet these criteria. Therefore, when evaluating projects, success is judged by how close the organization came to meeting the requirements as dictated by the plan they used, It is not enough to qualitatively state the project is successful, but it must be proved quantitatively.

Action Items: ● Establish en archival format for project data.

● Establish an archival schedule, so project progression can be reviewed throughout it's development cycle.

● Include qualifying events with the project data (explanatory narratives that describe deviations between the planned targets and actuals).

Limiting Factors, Root Causes, and Improvements

People naturally gravitate toward diagnosing symptoms es opposed to problems. If a product was late, end the late completion was driven by a given pert, the "cause" maybe attributed to the fact that the vendor wee lets (the *problem* may be that the vendor received the design late). Another cause could be that there weren't enough resources (the *problem* could be that a business decision was made to allocate resources to a more critical project).

Once symptoms boil down to problems, there has to be a mechanism in-piece to share that information, to reduce the likelihood of the same mistakes or conflicts from occurring again. An interesting quote encapsulates the idea here:

"Insanity, is doing the same thing over and over again, end expecting a different outcome."

Action Items: ● Create a lessons learned database. This should contain successes and failures concerning the process, suppliers, approaches and strategies

CASE STUDY - PART II

After the pilot class, General Physics constructed a report of findings. This report included ail materiel uncovered in the interviews, the issues analysis date obtained in the pilot, end a list of General Physics recommendations (corresponding to the issues raised through class end interviews, or as "add-ons" to recommendations made in class). This gave the committee implementing project management a body of information in which to revise their original objectives.

TRAINING MODIFICATIONS

With General Physics, Cummins made changes to the training materials end presentation, effectively integrating other initiatives (CPS, CTS, TQS) into the training. They also chose an "user friendly," low-end software to incorporate into the training (lengthening the training from the standard 3 days to 4 days). This allowed participants to re-enter the workplace with some knowledge of software applications

Cummins also entered a licensing agreement with General Physics. The licensing agreement entailed certification of on-site instructors for the course, and allowed Cummins access to the participant manuals. This was a strategy pursued for the long- term, since the intent was to roll project management out to increasingly more product teams,

UPPER MANAGEMENT

The members of the implementation committee felt it was crucial to get management actively involved in this new approach to new product development. In April of 1991, General Physics was called in to facilitate a two day session with the New Product Introduction Teem (NPIT) leaders. The reactions from managers during this two day session were es emotional as their employees.

The intent with this meeting was to educate management on the project management approach to new product introduction. If the efforts of end users of the 94HD were to be successful, management had to come together and think through issues surrounding their role in managing their people using project management.

The managers were introduced to the concepts, end actually applied some project management tools to their functional responsibilities on the program. The managers produced Statements of Work end Work Breakdown Structures. A great emphasis was placed on Leadership end the approach to Change Management.

The managers' emotion came out in defining and refining roles of functional managers in the project environment. Functional managers were intended to manage people who have cross-funtional responsibilities on the project. Since the authority in Cummins, es in most organizations, runs vertically (functionally), this was a cause for "spirited conversation," Questions around leadership, responsibility for the product, and specific roles were lively topics,

Not ail of these issues were resolved, but the implementation teem wee successful in educating management and getting them talking about how best to menage the 94HD using project management.

CUMMINS CATALYST FUNCTION

Cummins recognized the need for full-time support of project teems. Jim Frakes, along with seven program managers end project sponsors, were selected to lead implementation end serve as the catalyst function. This way, any question or confusion es to how ail the systems came together as a process could be remedied with little latency.

The catalyst function also has been instrumental in educating the overall philosophy of Cummins' approech to new product introduction. Individuals, given the skills, direction, and tools needed to do the job, won't necessarily follow through on execution. They have to be told end showed *why* they must execute, why it is important to the organization, and what they es individuals can derive from executing appropriately.

In the May of 1991, following the NPIT management meeting, the catalyst function initiated a kick-off meeting. Over 50 people attended, including functional leaders, project sponsors end program managers. The specific course the organization was going to take in using this new approach on the 94HD was mapped out. Roles end responsibilities were established to get the program off to the right start.

APPROACHES TO EVALUATION

Cummins has made the effort to audit project teams that have been through their curriculum of training (project management, CQS, CTS, TQS), The intent is to increase the feedback on "how things are going." Some of their preliminary findings were that end users found it difficult to transcend into the new culture that was being developed. It wee a slower process than anticipated. Getting people trained, and post training follow up to help individuals incorporate what they learned are areas that have been more difficult then expected.

Another audit was done on process effectiveness, as it related to the 94 HD program. A review of project documentation and the effectiveness, accuracy, and relevance associated with the contents were tediously reviewed. The review showed areas where improvement might be made. A more thorough audit of schedules and accuracy of estimates (time end budgets) is forthcoming.

The fell of 1992 will mark the first "user conference" at Cummins. The intent is to get users of the process together, and openly share success stories and approaches that work throughout the company. The organization as a whole is learning, end in a large organization, there is probably no better medium to get the information out than to hold a formal conference.

CONTINUOUS IMPROVEMENT FOR THE FUTURE

Because Cummins made a concerted effort to evaluate throughout development and implementation of a concurrent engineering/project management process, they have a body of information that will enable them to refine end grow the usage of the discipline throughout the organization. Many things were uncovered, end since have regenerated into new objectives.

Broadening the vision of project management is a recognized need. Its role in new product introduction must encompass the entire scope of the product, including concurrent engineering principles, and up to the point where that product is in the field. This vision must be simple enough for *anybody* (any employee) to use. It also must be dearer end simpler to

define roles at the cross functional end user level, as well as the functional managerial level.

KEYS TO SUCCESS

- Must be clear about the "management process" before training people and subsequently launching a new product development program.

- Each program participant must be "educated" as to the program objectives, the specific management process, end the rationale for that process.

- Leader selection and training are critical to success.

- Project Management/Concurrent Engineering training should have more of a "workshop" emphasis then tractional training. Addtionally:
  - Train cross-functional teams, not individuals.
  - Have trainees work on real project in-class.
  - "Act-out" the value of concurrent engineering in the workshops; this replicates how the teem will be expected to perform for the remainder of the program.
  - Train the teems in a sequence that allows them to immediately use the training when they re-enter the workplace.

- Project management training must lead to a fundamental change in the way people work together (concurrently).

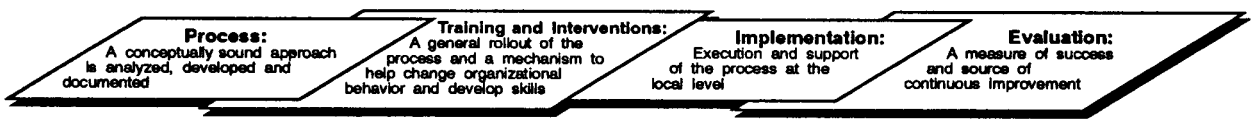
- Employee reward systems must be consistent with the project management/mncurrent engineering philosophy (wearing two hats, or, reinforcement for horizontal as well as vertical efforts on the organizational chart) .

- Functional Managers who are required to support cross-functional programs must have a visible forecast so resource can be planned to support the work (i.e., no surprises).

- It is important to nurture individual, informal relationships, in addition to the formal cross functional team. This may require the team to work physically in proximity to each other, as opposed to the separated, functional areas.

The development of "QSP101" is the end goal. This till be the comprehensive guide to Cummins approach to new product introduction. This considerable resource will be composed of the specific procedures, guidelines, and process flows that will serve es their constant guide through the new product introduction process, incorporating concurrent engineering with project management.

For a review and wrap up of what Cummins has done so far in implementing concurrent engineering with project management, please review their activities held against the four major areas of the Strategy Implementation Model.



THIS ENTAILS

- Review Cummins Technical System CTS Cummins Production System (CPS), and Cummins Total Quality System (TQS) procedures to assure understanding and compliance.
- Charter New Product Introduction Team(NPIT) made up of senior functions directors to empower and assign responsibilities. Assign a senior management sponsor.
- Develop a "Contract" with senior management that includes the product Profile, timetable, team management structure, resource maps, criteria and schedule for reviews and specific deliverables and measures.
- Define and form critical Subsystem Component Teams (cross-functional)
- Identify team leaders
- Review program with appropriate functional managers to assure understanding of support required.
- Establish expectations for employee's work plans and peformance reviews
- Conduct a "FMEA" on the management process prior to implementing (to assure potential failure modes of the process are identified and corrected).
- Define project training matrix
- Determine cross-functional team members
- Review membership with functional managers in order to gain commitment to support the project
- Conduct program education process:
  - Every team member and functional
  - Clearly articulate the process model including expectations, measures, procedures, etc.
- Provide "certified' trainers/coaches
- Conduct Project Management workshops
  - Senior management
  - Project team leaders
  - Project subsystem teams
- Senior Management "kick-off" meeting(s)
- Assign internal project management consultant (train, coach, nurture, mentor)
- Define project management audit process
- Define plan to incorporate concurrent engineering tools
  - CAD
  - Design for Quality
- Conduct users conference(s) to share success stories
- Regular reviews of the "management process" status with senior management/NPIT's
- Conduct final project audits as part of close out process:
  - Technical audit
  - TQS audit
  - Project Management
- Review performance against Cost, Quality, and Delivery goals
- Conduct project close-out process-document and place in technical library
- Evaluate training/education program for continuous improvement

CUMMINS IMPLEMENTATION MODEL
FIGURE 6